

# Durant<sup>®</sup>

INSTALLATION AND OPERATION  
MANUAL Number 58860-900-06

## PRESIDENT SERIES Model 5886-1400 THREE PRESET 6 DIGIT ELECTRONIC CONTROL



### TABLE OF CONTENTS

1	General Description
2	Specifications
4	Description of Operating Modes
8	Installation Instructions
14	Installation Instructions/Wiring
21	Operation
28	Scale Factors
36	Serial Communications
40	Troubleshooting
45	Transducers, Accessories and Replacement Parts List



## Cutler-Hammer

# EATON

## WARRANTY

---

**WARRANTY:** Cutler Hammer-Eaton Corporation warrants all products against defects in material and workmanship for a period of one (1) year from date of shipment to Buyer. This is a limited warranty limited to its terms. This warranty is void if the product has been altered, misused, taken apart or otherwise abused. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, ARE EXCLUDED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE.

**BUYERS REMEDIES:** Cutler Hammer-Eaton Corporation's obligations and liabilities under the foregoing warranty are limited to repair or replacement of the product without charge, provided it is mailed prepaid to Cutler Hammer-Eaton Corporation, Durant Instruments, 901 South 12th Street, Watertown, Wisconsin, 53094. A charge is made for repairing after the expiration of the warranty. IN NO EVENT SHALL CUTLER HAMMER-EATON CORPORATION BE LIABLE FOR CLAIMS BASED UPON BREACH OF EXPRESS OR IMPLIED WARRANTY OR NEGLIGENCE OR ANY OTHER DAMAGES WHETHER DIRECT, IMMEDIATE, FORESEEABLE, CONSEQUENTIAL OR SPECIAL OR FOR ANY EXPENSES INCURRED BY REASON OF THE USE OR MISUSE, SALE OR FABRICATION OF PRODUCTS WHICH DO OR DO NOT CONFORM TO THE TERMS AND CONDITIONS OF THIS CONTRACT.

**INDEMNIFICATION:** Buyer agrees to hold Cutler Hammer-Eaton Corporation harmless from, defend and indemnify Cutler Hammer-Eaton Corporation against damages, claims and expenses arising out of subsequent sales of Durant products or products containing components manufactured by Cutler Hammer-Eaton Corporation and based upon personal injuries, deaths, property damage, lost profits and other matters for which Buyer its employees or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L.92-573) and liability imposed upon any person pursuant to the Mansion-Moss Warranty Act (P.L.93-637), as now in effect or amended hereafter. The warranties and remedies provided for herein are available to Buyer and shall not extend to any other person.

**COMPLIANCE WITH OSHA:** Cutler Hammer-Eaton Corporation offers no warranty and makes no representation that its products comply with the provisions or standards of the Occupational Safety and Health Act of 1970, or any regulations issued thereunder. In no event shall Cutler Hammer-Eaton Corporation be liable for any loss, damages, fines, penalty or expense arising under said Act.

This manual constitutes proprietary information of Cutler Hammer-Eaton Corporation, and is furnished for the customer's use in operating the Series 5886 Count Control. Reproduction of this material for purposes other than the support of the 5886 Control or related products is prohibited without the prior written consent of Cutler Hammer-Eaton Corporation.

In the construction of the Control described herein, the full intent of the specifications will be met. Cutler Hammer-Eaton Corporation, however reserves the right to make, from time to time and without prior written notice, such departures from the detail specifications as may be required to permit improvements in the design of the product.

The information included herein is believed to be accurate and reliable, however, no responsibility is assumed to Cutler Hammer-Eaton Corporation for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

**WARNING:** This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

## GENERAL DESCRIPTION

The Durant Model 5886 is a versatile six-digit, three-preset, bi-directional count control. The control has three sets of transistor outputs (one for each preset), and two relay outputs. The two relays may each be operated by any of the three transistor outputs. The three transistor outputs may be programmed to occur sequentially or independently with the count. Output 1 and/or Output 2 may also be programmed to function as floating prewarn outputs. The control may be programmed to reset to zero or reset to the preset 3 value.

The 5886-1400 Model also features the ability to scale incoming counts. This means that for each pulse received on the count inputs, a fraction or multiple of that pulse is counted. The scale factor can be a number from 0.0001 to 9.9999. This number becomes a factor by which incoming count pulses are multiplied.

A non-volatile memory insures that the setup instructions will not be lost if power is interrupted. Count values will also be retained if a power loss interrupts a process or machine cycle.

The front panel of the control, Figure 1, is framed by a bezel that seals the panel to the mounting surface. A large, six-digit high visibility red LED display with a programmable decimal point position is located in the upper left portion of the panel. The keyboard has a Mylar front face and consists of ten data keys (0 through 9), "COUNT" key,

"RESET" key, "FUNCTION" key and "ENTER" key. The "1" key also serves as the "PRESET 1" key, the "2" key also serves as the "PRESET 2" key and the "3" key also serves as the "PRESET 3" key. The upper right portion of the front panel contains 4 yellow LED indicators for Count, Preset 1, Preset 2, and Preset 3.

The rear panel, Figure 2, contains screw terminals for use with stripped wire, either solid or stranded, from 28 to 14 gauge. The rear panel also contains two plug-in type replaceable relays with "form-C" contacts.

The counter provides two-way serial communication with remote devices using standard ASCII code and three selectable Baud rates. Count and preset data can be sent and preset data and a print request command can be received by the control via two 20-milliampere current loops. On Model 5886-1400 the Scale Factor may also be transmitted and received. Optional accessories are available to convert the communication loop to RS232, parallel BCD and multiplexed BCD formats.

The relay and transistor outputs can be timed from 0.01 to 99.99 seconds inclusive, latched until reset complete, unlatched at reset, remain latched until an unlatch input occurs or unlatch when the counter reaches an alternate preset. Outputs can also be operated in the Reverse mode.

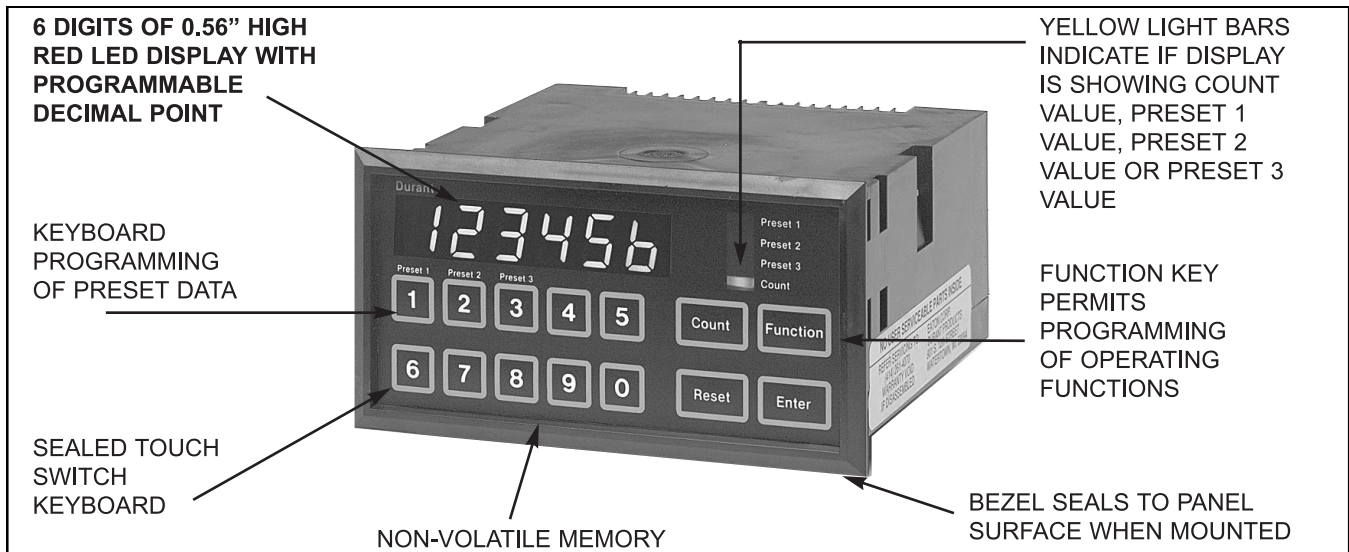


Figure 1. 5886 Dual Preset 6-Digit Electronic Control

## SPECIFICATIONS

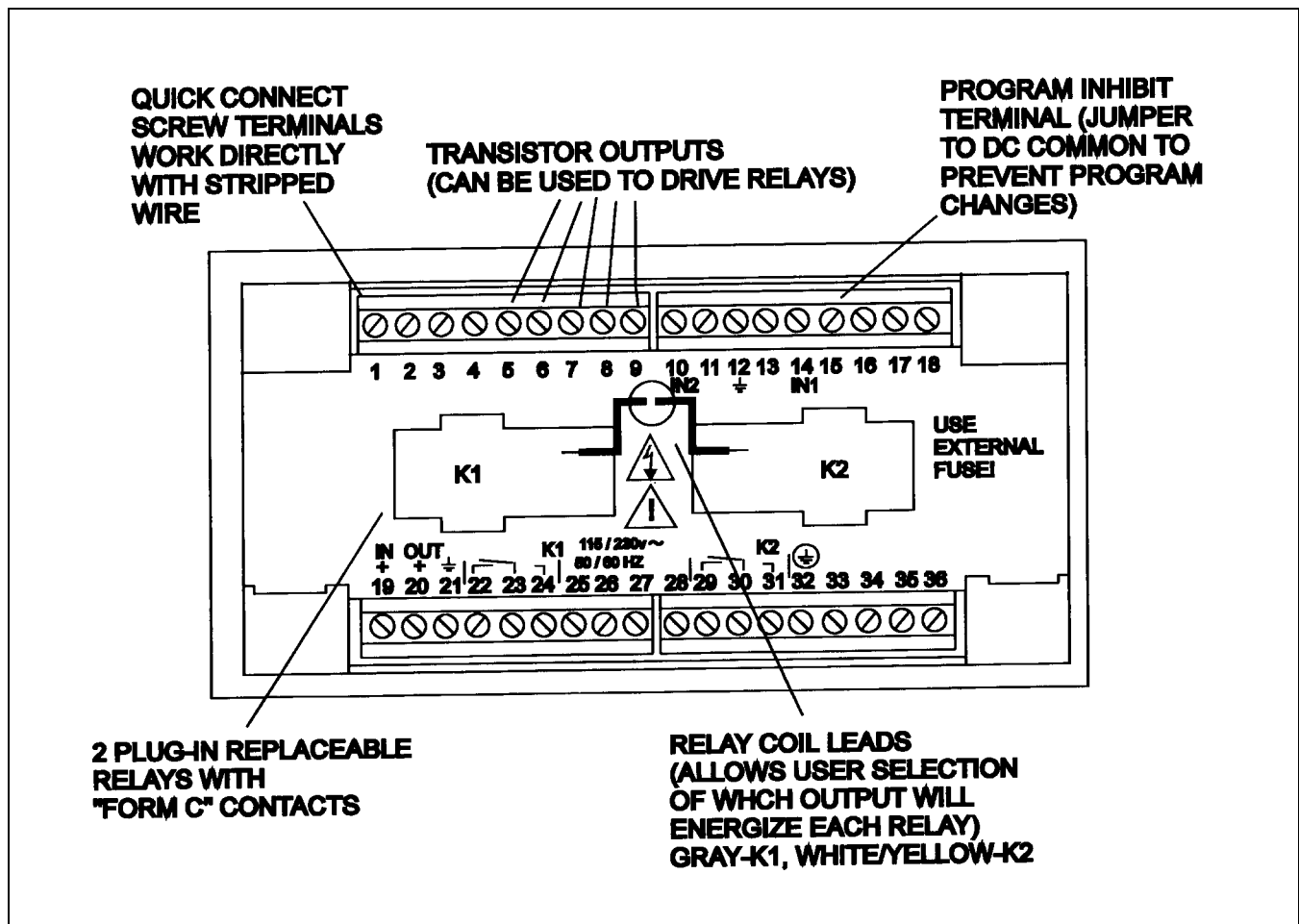


Figure 2. 5886 Rear Panel

The count input circuit provides the user with several options:

1. Separate add and subtract inputs.
2. Count input with up/down control input.
3. Quadrature input.
4. Count doubling in any of the three above configurations.
5. Count up input with count inhibit input.
6. High or low speed operation. Low speed operation provides maximum immunity to contact bounce and noise.

The control is equipped with self-diagnostics which test the internal memories for faults. Should a fault be detected, an indication given on the display. Displays and indicators are turned on in a patterned sequence for visual examination.



## SPECIFICATIONS

---

### POWER REQUIREMENTS:

#### AC Operation:

115/230 VAC (+10%, -20%) 47 - 63 Hz.

#### DC Operation:

11 - 28 VDC

#### Power:

18 Watts

### DC POWER OUTPUT:

15 VDC (+1, -2).

150 mA if powered from AC or less than 24 VDC.

100 mA if powered from 24 VDC or greater.

**NOTE: DC power output is only regulated if unit is powered by AC or greater than 18.5 VDC.**

### ENVIRONMENT:

#### Operating Temperature:

32 to 130° F (0 to 55° C)

#### Storage Temperature:

-40 to 160° F (-40 to 70° C)

#### Operating Humidity:

85% non-condensing relative

### PHYSICAL:

#### Case Dimensions:

5.38" W x 2.62" H x 5.91" D  
(136.7mm W x 66.5mm H x 150.1mm D)

#### Bezel Dimensions:

5.80" W x 3.04" H x 0.17" D  
(147.3mm W x 77.2mm H x 4.3mm D)

#### LIP:

0.2" (5.0mm)

#### Panel Cut-out Dimensions:

5.43" W x 2.68" H  
(138mm W x 68mm H, DIN)

#### Mounting Panel Thickness:

0.58" (14.7mm) maximum  
(without optional spacer provided)

.077" (1.96mm) maximum  
(with optional spacer provided)

Front panel will provide watertight seal with gasket provided.

#### Case Material:

Cadon FRX plastic case with Mylar front face overlay

#### Weight:

2.2 lbs. (1.0 Kg)

#### Display Size:

6 digits, 0.56" (14.2mm) H  
(with programmable decimal point location)

#### Memory Types:

PROM, RAM, Non-volatile NVRAM

### COUNTER:

#### Count Range:

6 digits (0 to 999,999) with rollover

#### Preset Range:

6 digits (0 to 999,999) (3 presets)

#### Count Modes:

Count with Add and Subtract inputs

Count with Up/Down direction input

(Hardware doubling for above modes is provided.)

Count with Count Inhibit input

Quadrature

Doubled Quadrature

#### Count Speed (Model 5886-0400):

0 to 7,500 CPS minimum for sensors with open collector transistor output.

0 to 5,000 CPS when hardware doubling IS implemented.

0 to 150 CPS when Low Frequency jumpers are installed.

Count Speeds for Model 5886-1400 are shown on page 28.

## DESCRIPTION OF OPERATING MODES

---

### COUNT INPUT RATINGS:

The count inputs are designed to work with current sinking sensors (open-collector NPN transistor output with or without passive pull-up resistor) or contact closures to DC Common.

#### Input Voltage:

High state (Logical "1", sensor off or contact open):

10.5 to 24.5 VDC when control is powered by AC line

7.0 to 24.5 VDC when control is powered by 11 VDC

11.0 to 24.5 VDC when control is powered by 16 VDC

Low state (Logical "0", sensor on or contact closed):

0 to 4.5 VDC when control is powered by AC line

0 to 3.0 VDC when control is powered by DC supply

#### Input Impedance:

6800 ohms to 15 VDC when control is powered by AC line

6800 ohms to 10 VDC when control is powered by DC supply

#### Input Current:

20 mA peak, 3 mA steady state

#### Input Response:

High State (Logical "1", sensor off or contact open)

High Speed (Low Speed jumpers not connected):

110  $\mu$ sec minimum at 15 VDC (6,800 ohms to +DC)

160  $\mu$ sec minimum at 13.5 VDC (50,000 ohms to +DC)

High State (Logical "1", sensor off or contact open)

Low Speed (Low Speed jumpers connected):

5.5 msec minimum at 15 VDC (6,800 ohms to +DC)

7.5 msec minimum at 13.5 VDC (50,000 ohms to +DC)

Low State (Logical "0", sensor on or contact closed)

High Speed (Low Speed jumpers not connected):

20  $\mu$ sec minimum at 0.1 VDC (0 ohms to DC Common)

45  $\mu$ sec minimum at 1.5 VDC (500 ohms to DC Common)

Low State (Logical "0", sensor on or contact closed)

Low Speed (Low Speed jumpers connected):  
1.0 msec minimum at 0.1 VDC (0 ohms to DC Common)

2.0 msec minimum at 1.5 VDC (500 ohms to DC Common)

### CONTROL INPUTS:

#### Impedance:

4.75K ohms to +5 VDC.

#### Threshold:

High +3.5 to +22 VDC.

Low +0.0 to +1.0 VDC.

#### Response Time:

Min. High 5.3 mS.

Min. Low 3.9 mS.

**NOTE:** The reset and unlatch signals will both occur in less than 200 microseconds after the input signal is detected. The start of the print will occur within 2 milliseconds after the input is detected if the unit is not counting.

### OUTPUT RATINGS:

#### Relay Contacts

Type: Form C (SPDT)

U.L./C.S.A. Contact Ratings:

10 amps, resistive, @ 24 VDC or 230 VAC

1/3 HP @ 115 VAC or 230 VAC

150 VDC maximum switched voltage

Mechanical Life: 5,000,000 operations

Electrical Life: 100,000 operations at resistive rating

## DESCRIPTION OF OPERATING MODES

---

### Transistor Outputs

Type: Open collector NPN transistor with  
Zener diode transient surge protection.  
Load Voltage: 30 VDC maximum  
Load Current: 300 milliamps maximum per  
transistor. 480 milliamps total for all  
transistors.

#### Rev. 50-59:

Use 90 milliamps per relay coil when  
calculating total transistor current.

#### Rev. 60 - up:

Use 5 milliamps per relay coil when calculating  
total transistor current.

### OUTPUT OPERATING MODES:

#### Actuation:

Independent  
Prewarn (Outputs 1 and 2 only)  
Sequential

#### Unlatch:

After timeout  
With external signal  
When Reset Energized  
When Reset De-energized  
At Alternate Output

#### Reverse:

Reversed operation of any transistor outputs

### COUNTER OPERATING MODES:

Reset to Zero  
Reset to Preset  
Auto Recycle  
Maintained Reset  
Momentary

### DIAGNOSTIC MODES:

ROM Checksum  
RAM Bit Test  
NVRAM Read/Write Test  
NVRAM Store Test  
NVRAM Checksum  
Watchdog Timer  
Display and Led Indicator Test

### COMMUNICATIONS:

#### Interface Type:

Dual port 20 milliamp current loop

#### Speed:

110, 300 and 1200 Baud, user selectable

#### Data Type:

Standard ASCII code

#### Format:

Start bit, 7 ASCII data bits, Parity bit, one or  
two Stop bits  
(Even parity for Serial Data Output, no  
parity for Serial Data Input)

#### Information Transmitted:

Count value  
Preset 1 value  
Preset 2 value  
Preset 3 value  
Scale Factor (Model 5886-1400 only)

#### Information Received:

Print request  
Preset 1 value  
Preset 2 value  
Preset 3 value  
Scale Factor (Model 5886-1400 only)

### SCALE FACTOR:

#### Range:

5 digits (0.0001 to 9.9999)

## DESCRIPTION OF OPERATING MODES

---

### COUNT MODES

The control has five count modes, which are: Count with separate add and subtract inputs, Count with direction control input, Count up with inhibit control input, Quadrature, and Doubled Quadrature.

#### Add and Subtract Inputs

The add and subtract mode allows separate signals to simultaneously add and subtract counts. It can be used to indicate material stretch, subtract defective parts from total parts produced, etc.

#### Count with Directional Control

Count with direction control mode uses one input for incoming count pulses and the other to inform the control whether the pulses should be used to add or subtract counts. Count with direction may be used when an item must be measured or positioned. Many types of sensors or control systems utilize count signals of this nature.

In both of the above count modes, the counter will normally increment or decrement on the falling edge of the incoming count pulse. (The falling edge is defined as the moment in time when the pulse changes state from +DC to DC Common potential.) Doubling allows the counter to increment or decrement on both the falling and the rising edges of the pulse. (The rising edge is defined as the moment when the pulse changes state from DC Common to +DC potential.)

#### Count with Inhibit Control

The count up with inhibit control mode provides an input which increments the control and an input which causes incoming count pulses to be ignored. This mode can be used when defective material must be ignored or when inspection samples are taken without incrementing the counter. The count up with inhibit control mode may not be doubled.

#### Quadrature Inputs

Quadrature counting makes use of two count signals which are phase shifted by 90 degrees. The detection of which signal is rising first allows the counter to know in what direction the shaft is turning. When Quadrature count sources are being

used, the Double Input must always be connected to DC Common to allow the quadrature signals to be decoded.

#### Quadrature Input Doubled

Doubled Quadrature is implemented by programming. This mode allows the counter to count on both the rising and falling edges of the incoming count pulses. The number of pulses per revolution of the shaft encoder is effectively doubled, increasing the resolution without any loss of accuracy.

### COUNT SCALING

When the 5886-1400 receives a count pulse in any count mode, the count is increased by the scale factor for count-up pulses and decreased by the scale factor for count-down pulses. The count shows the accumulated total in whole increments.  $\text{Accumulated Total} = \text{Total Number of Pulses} \times \text{Scale Factor}$ .

### DECIMAL POINT LOCATION

The location of the decimal point on the display is programmed and may be located between any two digits on the display, or omitted. When a printer is connected to the serial communication output, the decimal point is printed.

The decimal point remains on the display whenever the actual value of the counter or the preset value is being displayed. It is not lit when function codes or other function entries are being displayed. The timeout function automatically displays the decimal point to indicate 0.01 second increments.

### COUNTER OPERATING MODES

#### Reset Mode

Reset mode is used when the counter should start at zero and count up to the preset values. Reset mode implies that when the "RESET" key is pressed or the Reset input is energized, the counter is reset to zero.

#### Preset Mode

Preset mode is used when the control must start at a preset value and count down to zero. Preset

## DESCRIPTION OF OPERATING MODES

mode implies that when the “RESET” key is pressed or the Reset input is energized, the control is reset to preset 3; that is, forced to have a value equal to the preset 3 value. When the control is in the Preset mode, transistor output 3 turns on when the counter reaches zero.

### Automatic Recycle Operation

It may be desirable to have the control automatically reset itself for repeated cycles. Auto Recycle can be programmed to occur when any one, any of two or any of the three transistor outputs turn on. When in the Reset mode and any of the selected outputs turn on, the counter is automatically reset to zero. When in the Preset mode and any of the selected outputs turn on, the counter is automatically reset to the Preset 3 value.

### OUTPUT AND RELAY OPERATION

The outputs of the control consist of five transistors and two relays. The output associated with Preset 1 and the output associated with Preset 2 each provide a pair of transistors. The two transistors in each pair operate in parallel; that is, when one of the transistors is turned on, the other is turned on as well. The fifth transistor is associated with Preset 3. The collectors of each of these transistors is brought out to individual screw terminals.

The relays are uncommitted and may be assigned by the user to any of the 5 transistor outputs. This is done by connecting a single wire for each relay to the desired transistor output screw terminal. When shipped from the factory, relay K1 is

prewired to Output 1 (terminal 8) and relay K2 is prewired to Output 2 (terminal 9).

### Turning Outputs On

There are three programmable modes which affect when the transistor outputs turn on (conduct to DC Common.) These modes are:

Independent Mode  
Prewarn Mode  
Sequential Mode

In addition, the reset and preset modes affect when transistor output 3 turns on.

In the Independent and Prewarn modes, each output turns on whenever the count reaches the value specified in Figure 3. This occurs regardless of the order in which the presets are reached. Note that the Prewarn/Preset modes operate the same as the Independent/Preset mode.

The Prewarn mode allows Output 1 and/or Output 2 to be programmed to turn on a specific number of counts before Output 3. This mode is valid only when the control is programmed to Reset to Zero. In the Prewarn mode, Preset 1 and/or Preset 2 are set to the number of counts before Output 3 at which the Prewarn Output(s) are desired. When Preset 3 is changed, the count values at which Output 1 and/or Output 2 actuate (Prewarn Values) are also changed by the same amount. The Prewarn Value(s) (Preset 3 minus Preset 1 or Preset 3 minus Preset 2) may be displayed by

EVENT	PROGRAMMABLE FUNCTION									
Count Reaches	Independent		Prewarn**						Sequential	
			Prewarn 1		Prewarn 2		Prewarn 1 & 2			
	Reset	Preset	Reset	Preset	Reset	Preset	Reset	Preset	Reset	Preset
Preset 1	1	1		1	1	1		1	1*	1*,2*,3*
Preset 2	2	2	2	2		2		2	2*	
Preset 3	3		3		3		3		3*	
Preset 3-Preset 1			1				1			
Preset 3-Preset 2					2		2			
Zero		3		3		3		3		

“1”, “2”, or “3” indicates which output turns on.

\*Output turns on only if it is next in sequence.

\*\*The Preset for a Prewarn Output must be less than Preset 3.

**Figure 3. Output Actuation Table**

## INSTALLATION INSTRUCTIONS

selecting the appropriate Function Code (see Figure 22).

In the Sequential mode, each output turns on as specified in Figure 3, only if that output is next in sequence (see Figure 4). The counter automatically resets and advances the sequence after the first and second events shown in Figure 4. In the Reset mode the counter is automatically reset to zero, in the Preset mode the counter is automatically reset to Preset 2 after the first event and Preset 1 after the second event shown in Figure 4. The counter does not automatically reset after the third event unless automatic recycle is programmed to occur at that output. An automatic recycle at any event resets both the counter and the sequence. In the count mode, the Preset LED's light to show which Output is next in sequence.

In the Sequential mode, the reset input or reset key may be used at any time to reset both the counter and the sequence. A separate programmable input (terminal 16) may be used at any time to reset the counter without resetting the sequence.

### Turning Outputs Off

Once a transistor output is turned on, it remains on until it is unlatched. There are five ways to unlatch each output:

1. Timeout

Each output has a separate timeout function. The timeout function causes an output to unlatch after a specified "on" time. The allowable time range is from 0.01 to 99.99 seconds. A value of 0 inhibits the timeout function for that output. In this case, the output remains on until unlatched by one of the following methods.

2. Unlatch at Reset (UAR)

Each output may be programmed to unlatch when the reset key is pushed or the reset input is energized (goes low).

3. Latch Until Reset Complete (LURC)

Each output may be programmed to unlatch

when the reset key is released or the reset input is de-energized (goes high).

4. Unlatch at Alternate Output

Each output may be programmed to unlatch when one or either of the remaining two outputs turns on.

5. Unlatch Inputs

Two programmable unlatch inputs may be used to unlatch any two of the three outputs. When an unlatch input is energized, the selected output unlatches.

Event	Sequential Mode	
	Reset	Preset
First	Output 1	Output 3
Second	Output 2	Output 2
Third	Output 3	Output 1

Figure 4. Output Sequence Table

### Reverse Outputs

Each transistor output may be programmed to operate in reverse. A reversed output is normally on (conducts to DC Common) and turns off when Figure 3 shows that it should turn on. Likewise, a reversed output turns on when it is timed out or unlatched.

When power is interrupted, all outputs turn off and will remain off when power is reapplied. It is therefore necessary to "enable" all reversed outputs after a power interruption. This is usually done by energizing the appropriate unlatch input(s) or by programming the reversed outputs to latch until reset complete and then resetting the control.



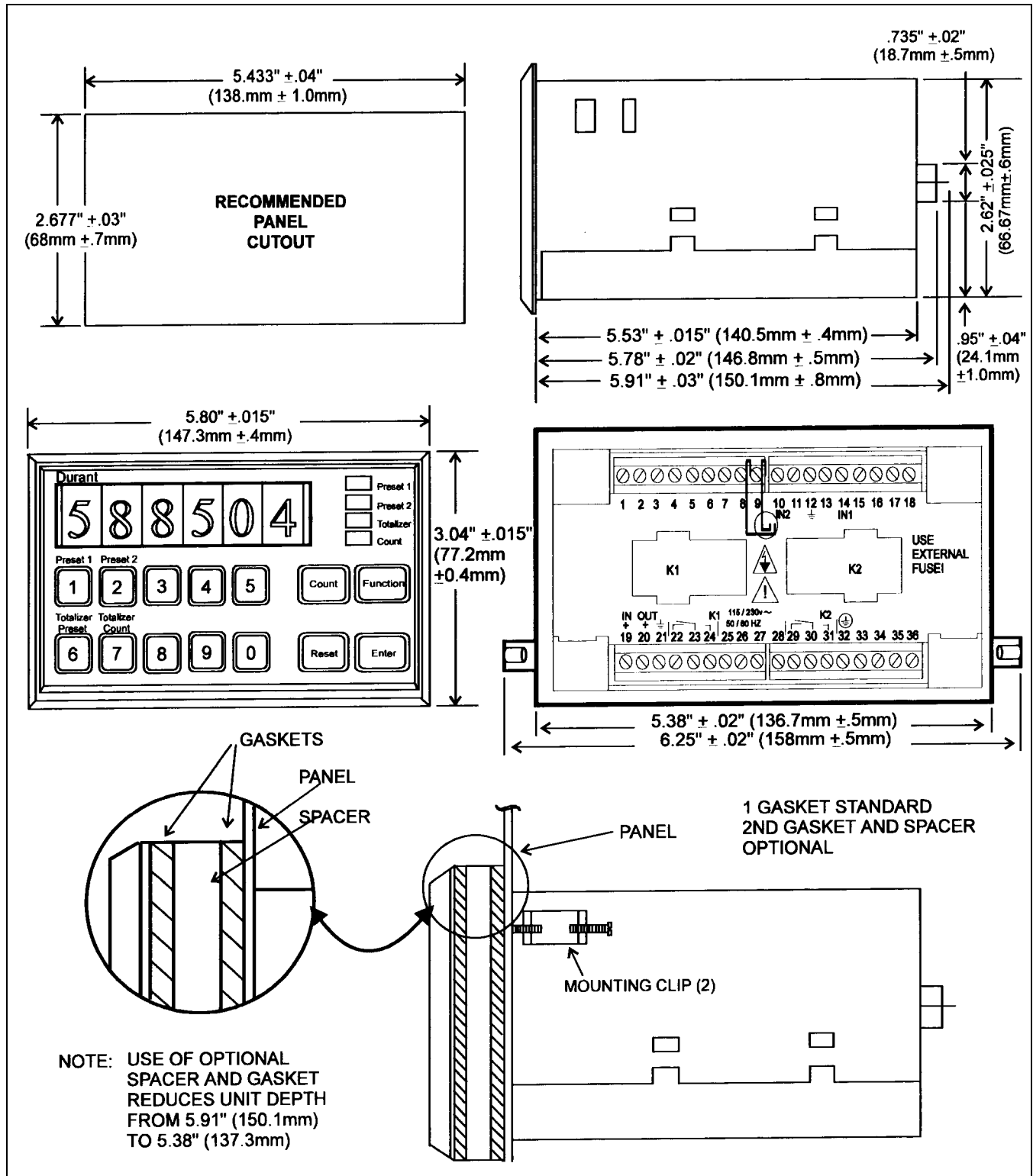
**A POWER OUTAGE CAUSES THE OUTPUTS AND RELAYS TO TURN OFF REGARDLESS OF THE OPERATING MODE SELECTED. BE SURE THAT THIS EFFECT IS NOT HAZARDOUS TO THE OPERATOR.**

# INSTALLATION INSTRUCTIONS

## GENERAL

When mounting, the location selected must provide for adequate air circulation space around the unit. Avoid locating the unit near instruments

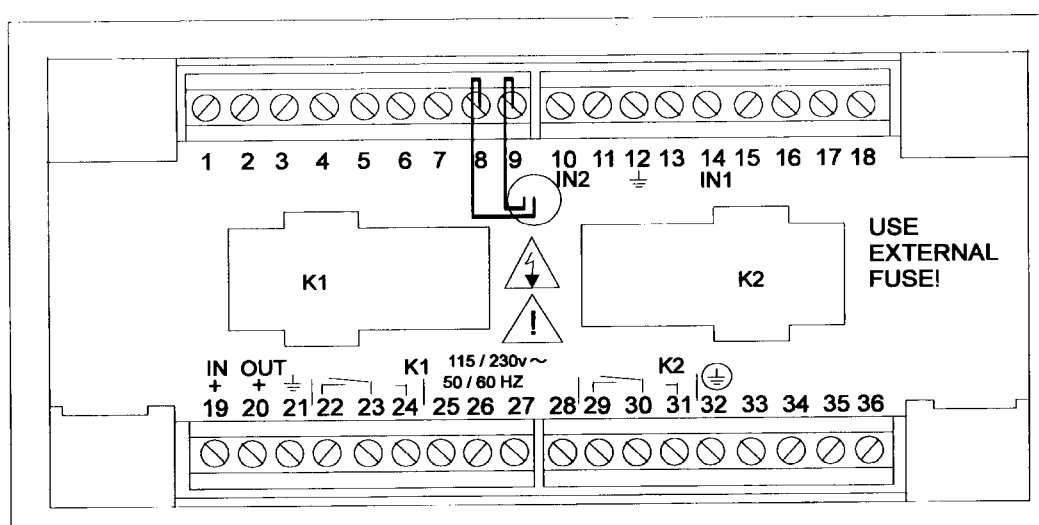
and/or equipment that generate excessive heat. Figure 5 shows recommended cutout and product details as well as mounting details.



# INSTALLATION INSTRUCTIONS

## WIRING - GENERAL

1. Disconnect all power before wiring terminals.
2. Do not use machine power service for 115/230 VAC input power to the control. A dedicated or lighting circuit is recommended.
3. Keep all signal lines as short as possible.
4. Do not bundle or route signal line(s) with power carrying lines.
5. Tools required are a wire stripper and a small common screwdriver.
6. Refer to the setup chart Figure 6 for terminal designations.
7. Use 18 ga. Minimum (1mm<sup>2</sup>, 600V) and 14 ga. Maximum (2.1mm<sup>2</sup>, 600V) wire for AC power wiring.
8. See Figure 8 for correct fuse to be used in the power input wiring.



**TERMINAL IDENTIFICATION**

1	BYPASS PRESET 1 INPUT	19	11-16V DC SUPPLY
2	OUTPUT UNLATCH A	20	15V DC POWER OUTPUT
3	OUTPUT UNLATCH B	21	DC COMMON
4	BYPASS PRESET 2 INPUT	22	RELAY CONTACT NC
5	TRANSISTOR OUTPUT 1	23	RELAY CONTACT COM
6	TRANSISTOR OUTPUT 2	24	RELAY CONTACT NO
7	TRANSISTOR OUTPUT 3	25	AC POWER INPUT
8	TRANSISTOR OUTPUT 1	26	AC POWER INPUT
9	TRANSISTOR OUTPUT 2	27	AC POWER INPUT
10	COUNT INPUT 2	28	AC POWER INPUT
11	LOW FREQUENCY SELECT 2	29	RELAY CONTACT NC
12	DC COMMON	30	RELAY CONTACT COM
13	LOW FREQUENCY SELECT 1	31	RELAY CONTACT NO
14	COUNT INPUT 1	32	CHASSIS GROUND
15	PROGRAM INHIBIT	33	SERIAL DATA INPUT -
16	PRINT REQUEST/RESET COUNTER	34	SERIAL DATA INPUT +
17	RESET	35	SERIAL DATA OUTPUT +
18	DOUBLE INPUT	36	SERIAL DATA OUTPUT -

**Figure 6. Terminal Designations**



# INSTALLATION INSTRUCTIONS

---

## TERMINAL ASSIGNMENTS AND FUNCTIONS

### #1 - BYPASS PRESET 1 INPUT

Connecting this terminal to DC Common causes the counter to ignore Preset 1. When the counter reaches Preset 1, Transistor Output 1 remains off and any other functions (such as auto recycle at Output 1) will not occur.

#### NOTE:

In the sequential mode, this input must be energized before the counter starts counting to or from preset 1 for bypass to occur.

### #2 AND 3 - TRANSISTOR OUTPUT UNLATCH INPUTS

These two terminals are programmable inputs which may be used to unlatch any two of the three transistor outputs. Function code 49 is used to select which output is unlatched by each input (see Figure 21). When an Unlatch input is energized, the selected output turns off. If the output is already off, the Unlatch input has no effect. If the output has been reversed the Unlatch input turns the output on.

### #4 - BYPASS PRESET 2 INPUT

This input operates the same as #1 above except it applies to Preset 2 and Transistor Output 2.

### #5 AND 8 - TRANSISTOR OUTPUT 1

These outputs are open collector NPN transistors with built-in transient overvoltage protection in the form of zener diode clamping. Each transistor is rated at 30 Vdc maximum and can sink up to 300 milliamps. Both transistors turn on as shown in Figure 3 for Output 1.

### #6 AND 9 - TRANSISTOR OUTPUT 2

These outputs have the same configuration as #5 and 8 above except that they turn on as shown in Figure 3 for Output 2.

### #8, 9, 12 AND 21 - DC COMMON

These terminals are internally connected to the negative side of the DC power supply.

### #10 AND 14 - COUNT INPUTS

These two count inputs are used to increment or decrement the counter. Terminal #14 is labeled "COUNT INPUT 1" and terminal #10 is "COUNT INPUT 2." The table shown in Figure 7 lists the operation of the two count inputs as related to the count function, and indicates how each input causes the counter to operate when a DC Common signal is applied.

### #11 AND 13 - LOW FREQUENCY SELECT INPUTS

When contact closures are used for count sources, it must be remembered that the contacts will bounce slightly each time they close. This slight bounce can cause extra counts to be entered into the counter. This effect can be eliminated by limiting the allowable frequency response at the count inputs. The low frequency select terminals reduce the count input frequency response from 7500 PPS to 150 PPS when they are connected to DC Common. Terminal #13 is LOW FREQUENCY SELECT for COUNT INPUT 1 (terminal #14) and terminal #11 is LOW FREQUENCY SELECT for COUNT INPUT 2 (terminal #10). Low frequency is selected by placing a jumper between terminal #11 and/or terminal #13 and DC Common. Use the Low Frequency inputs whenever possible to guard against electrical noise and interference.

### #15 - PROGRAM INHIBIT INPUT

The PROGRAM INHIBIT terminal, when connected to DC Common through the use of a jumper, prevents all of the programming functions from being changed. Modification of the Preset values can also be prevented with this jumper if Function Code 41, Preset Lock, is set to a value other than "0."

# INSTALLATION INSTRUCTIONS

COUNT MODE	INPUT 1 (Term. #14)	INPUT 2 (Term. #10)
Separate add and subtract Count up with inhibit control Quadrature * Count with up/down control Doubled quadrature*	Subtract counts Add counts Input A Count input Input A	Add Counts Inhibit counts Input B Up/Down control Input B

\*NOTE For both Quadrature modes, the wires to inputs #1 and #2 may be interchanged to reverse count direction Terminal #18 must also be tied to DC Common (terminal #8 or #12) for proper quadrature operation.

**Figure 7. Count Input Operating Modes**

## #16 - PRINT REQUEST/RESET COUNTER INPUT

Terminal 16 is a programmable input which may be used in one of two modes. Function Code 84 is used to select the desired mode.

### Print Request/Display Latch Mode

When terminal 16 is energized in this mode, the data specified in Function Code 91 is transmitted through the Serial Data Output terminals. The data is transmitted once each time terminal 16 is energized.

In this mode, terminal 16 also serves to latch the count value on the display while the control continues counting. The display remains latched until terminal 16 is deenergized.

### Reset Counter Mode

In this mode, terminal 16 is used to reset the counter without resetting the output sequence. If the control is not in the sequential mode, terminal 16 defaults to the Print Request/Display Latch mode.

## #17 - RESET INPUT

When terminal #17 is connected to DC Common through an external switch, relay, or sensor, the counter is remotely reset. If the counter is in the Reset mode, energizing this input returns the counter value to zero. If the counter is in the Pre-set mode, the counter value is changed to the pre-set 3 value. If the control is in the sequential mode, the reset input also resets the sequence. If the Unlatch At Reset or Latch Until Reset Complete

mode of operation is selected for any outputs, the input unlatches the selected combination of transistor outputs in addition to resetting the control. The Reset input has the same function as the front panel "RESET" key.

## #18 - DOUBLE INPUT

Connecting the DOUBLE INPUT to DC Common selects count doubling for either the Add and Subtract or the Count with Direction Control count modes. When either Quadrature or Doubled Quadrature count mode is selected, the Double Input must be connected to DC Common for proper operation.

## #19 - BATTERY OR EXTERNAL 11-16 VDC SUPPLY

The power source can be either an external battery (11 to 16 volts) or a 15 VDC power supply. Connect this terminal to the positive side of the external low voltage supply and a DC Common terminal to the negative side.

## #20 - 15 VDC POWER OUTPUT

This terminal may be used to power external devices such as sensors, a shaft encoder, or indicator lamps. The terminal supplies a regulated 15 VDC (+1V, -2V) to the loads at a maximum of 100 milliamps. The 15 VDC supply is generated only when the unit is powered by 115 or 230 VAC.

## #22 THROUGH 24 AND #29 THROUGH 31 - RELAY CONTACTS

Each of the 2 internal relays provides a set of 5 amp resistive dry form "C" contacts (SPDT) rated

# INSTALLATION INSTRUCTIONS

---

at 115 or 230 VAC. For K1 terminal #23 is common to terminal #22(NC) and terminal #24(NO). For K2 terminal #30 is common to terminal #29(NC) and terminal #31(NO).

## #25 THROUGH 28 - AC POWER INPUT

For 115 VAC operation, jumper terminal #25 to #28, and #26 to #27. Connect the AC line power to #25 and #26.

For 230 VAC operation, jumper #26 to #28. Connect the AC line power to #25 and #27.

## #32 - CHASSIS GROUND

This terminal must be connected to earth ground to provide proper noise immunity. When shielded cable is used for sensors or communications wiring, connect the shields to this terminal.

When the unit is being used in a mobile, battery powered application, this terminal **MUST** be connected to CHASSIS GROUND.

A factory installed green wire connects this terminal to DC Common. This is done to provide added immunity to static discharge and electrical interference. In control systems incorporating several electronic devices, it is accepted practice to provide one SYSTEM grounding point. In this case, the green wire as provided may be removed and SEPARATE green wires attached to both Chassis Ground and DC Common for connection to the common system grounding point.

For applications which require isolated DC Common and Chassis Ground, the green jumper may be removed entirely. However, extra care must be taken to route current carrying wires away from the counter as much as possible. Shields in transducer cables should be connected to Chassis Ground wherever possible.

## #33 AND 34 - SERIAL DATA INPUT

The serial communications inputs are used to receive new preset values and print requests. The interface utilized is a standard 20 milliamp current loop with a user selectable Baud rate.

Terminal #33 is the negative side of the current loop and #34 is the positive side. When connecting serial communications between the unit and any other device, note that SERIAL DATA OUT PLUS (SDO+) from the transmitting device is wired to the SERIAL DATA IN MINUS (SDI-) of the counter. Likewise, SDO- from the transmitting device is wired to SDI+ of the counter.

## #35 AND 36-SERIAL DATA OUTPUT

The counter has serial communications output which may be used to transmit the current count value, the preset 1 value, the preset 2 value, the preset 3 value, or any combination. The Baud rate of the 20 milliamp current loop is user selectable. However, the Baud rate selected is the same for serial input and serial output communications.

Terminal #36 is the negative side of the output current loop and terminal #35 is the positive side. When connecting serial communications between the counter and any other device, note that SERIAL DATA OUT PLUS (SDO+) from the counter is wired to the SERIAL DATA IN MINUS (SDI-) of the device receiving the data. Likewise, SDO- from the counter is wired to SDI+ of the receiving device.

## RELAY COIL LEADS

The gray lead is internally connected to the K1 relay coil and the white/yellow lead is internally connected to the K2 relay coil. As shipped from the factory, the gray lead (K1) is connected to Output 1 (terminal 8) and the white/yellow lead (K2) is connected to Output 2 (terminal 9). These terminals conduct to DC common when energized. The opposite side of each relay coil is internally connected to +12 Vdc.

## INTERCONNECTION

After determining the desired operating mode, select the appropriate Figure 8 through 21 for connection diagrams for the application.



# INSTALLATION INSTRUCTIONS/WIRING

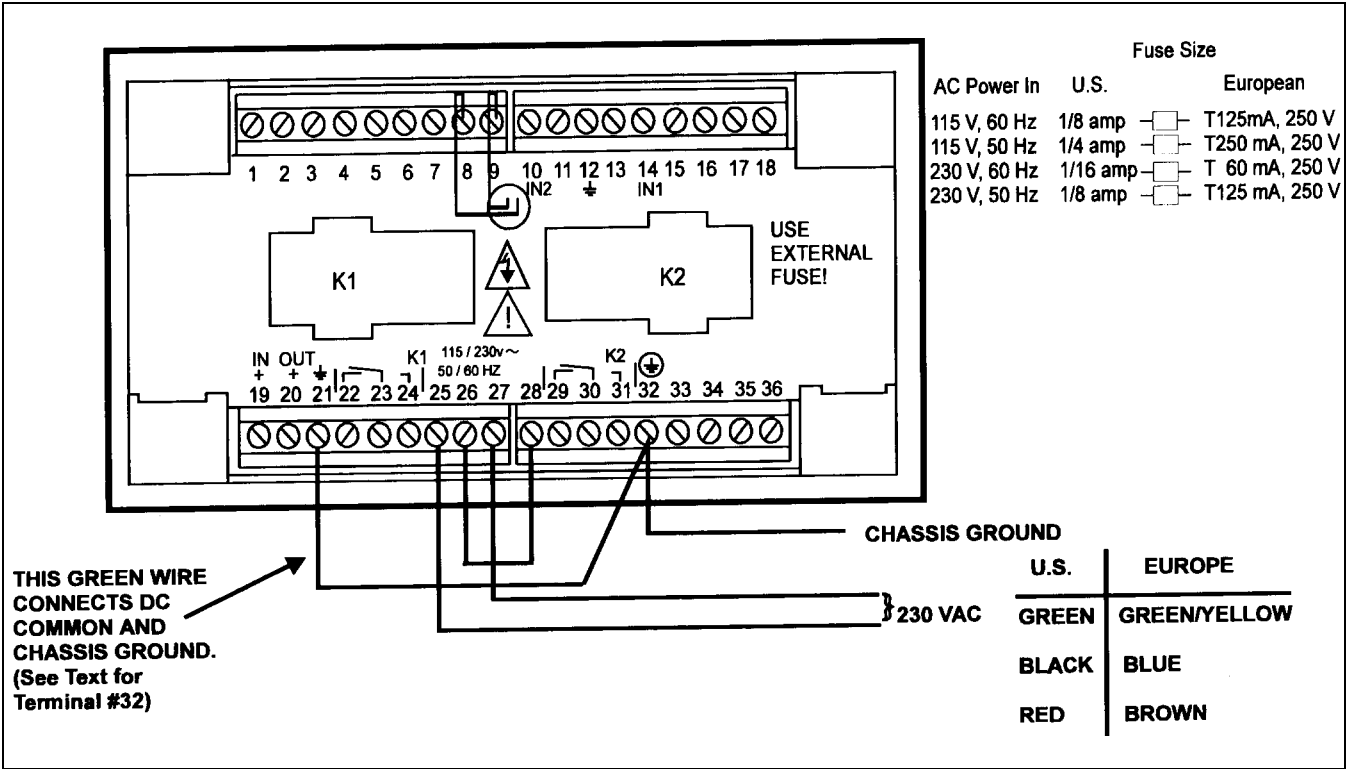


Figure 9. 230 VAC 47/63 Hz Power Connection

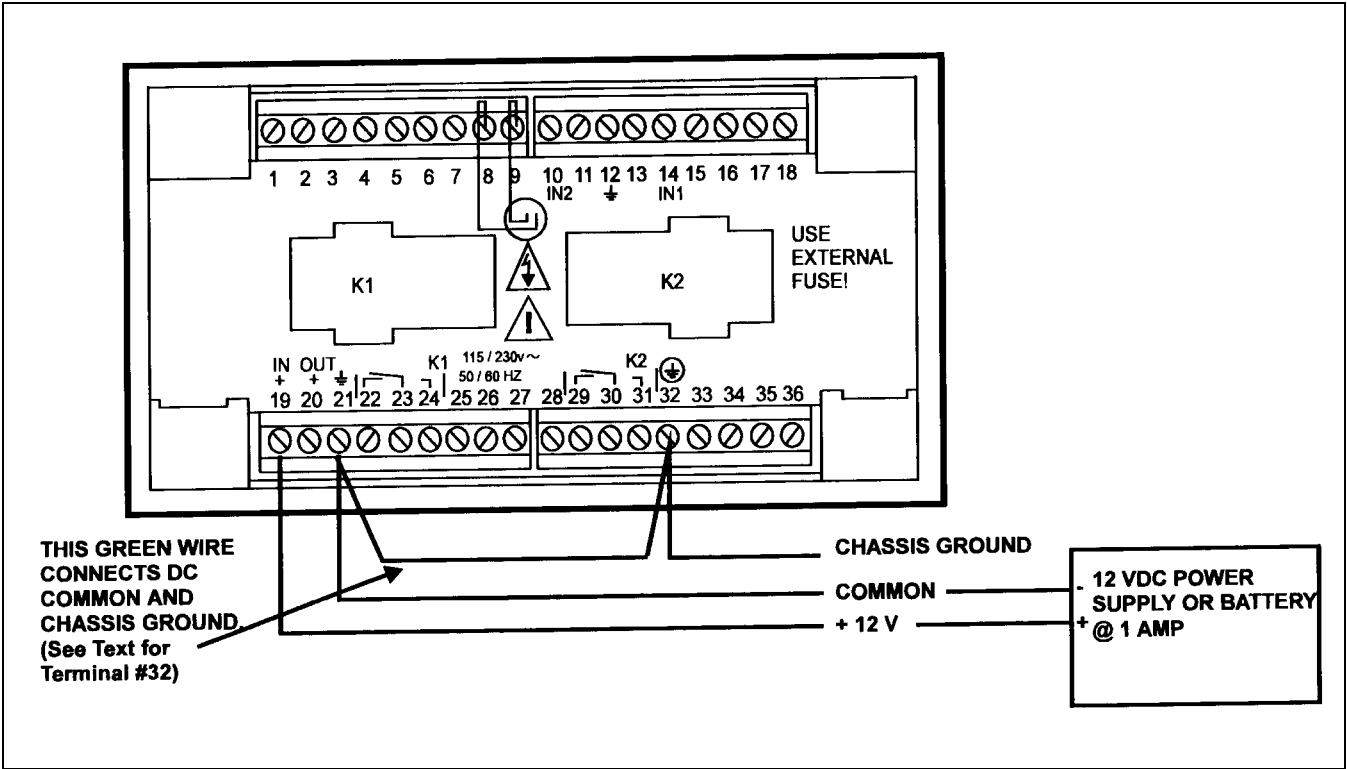
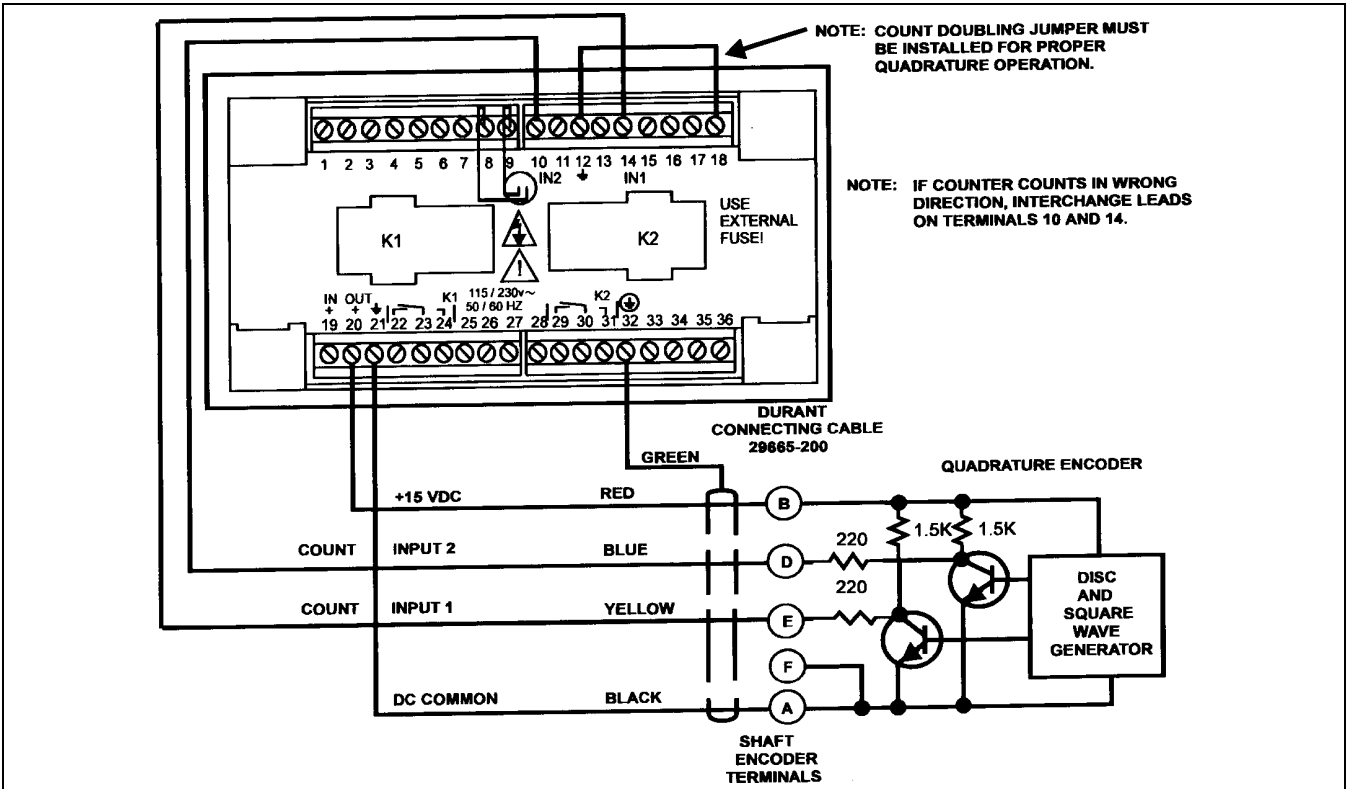
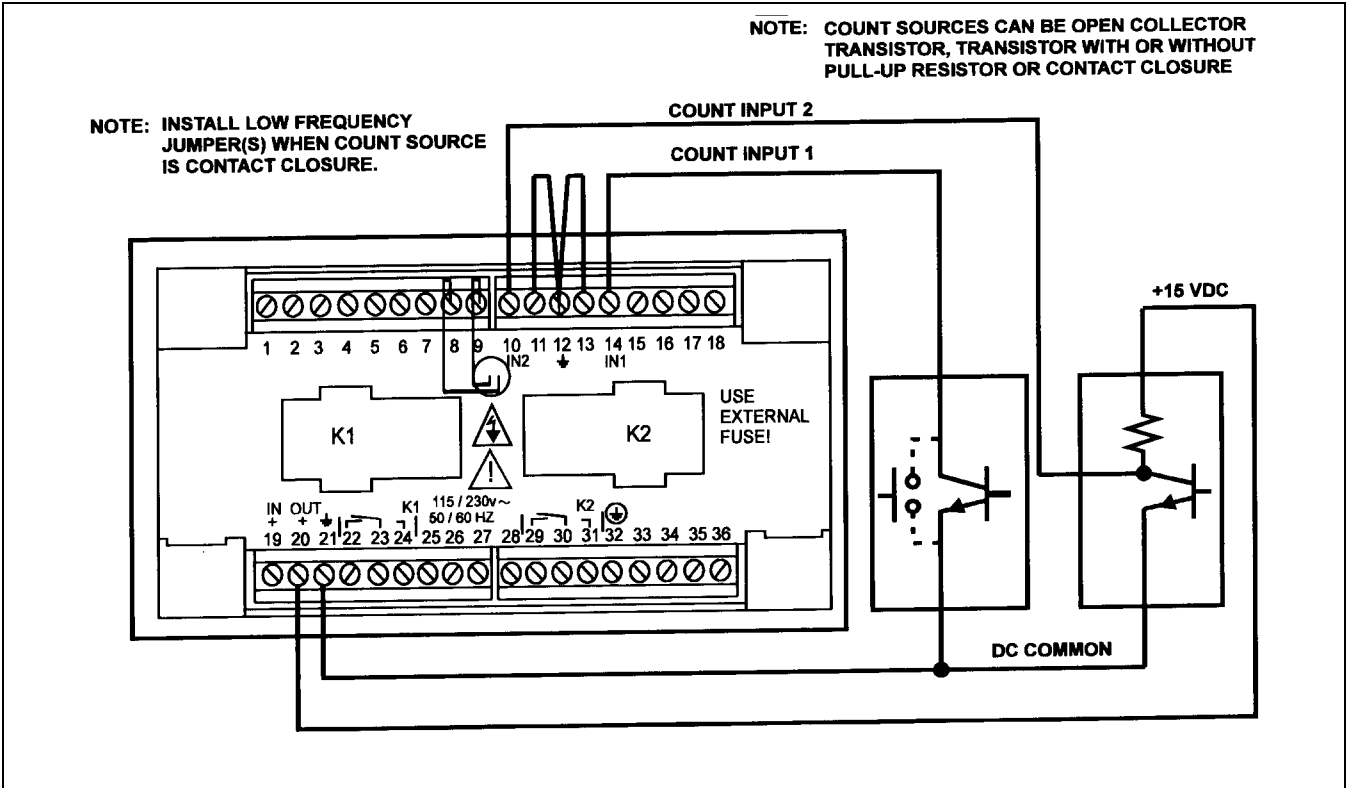
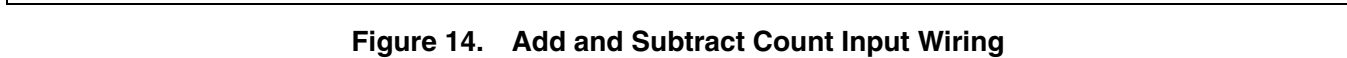


Figure 10. 12 VDC Power Connection

# INSTALLATION INSTRUCTIONS/WIRING





INSTALLATION INSTRUCTIONS/WIRING

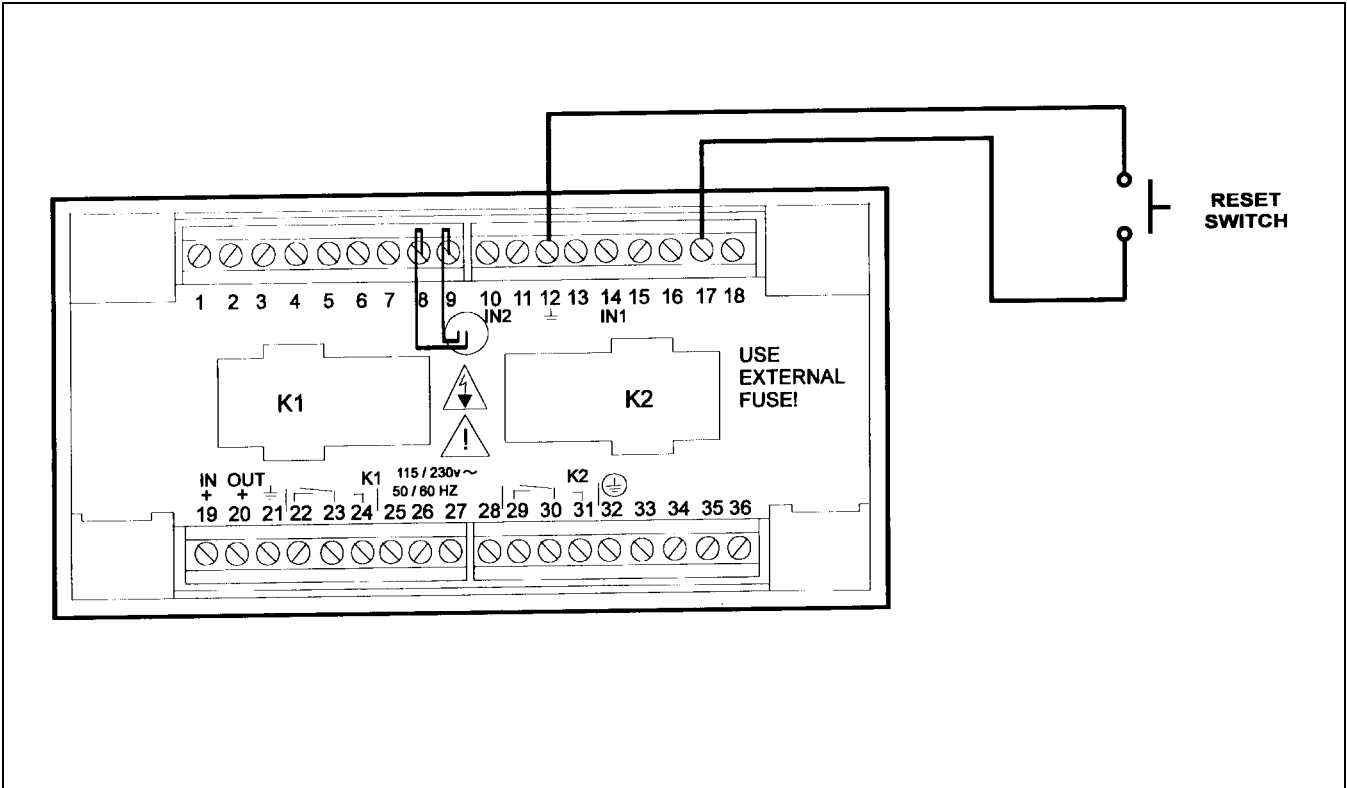


Figure 15. Remote Reset Wiring

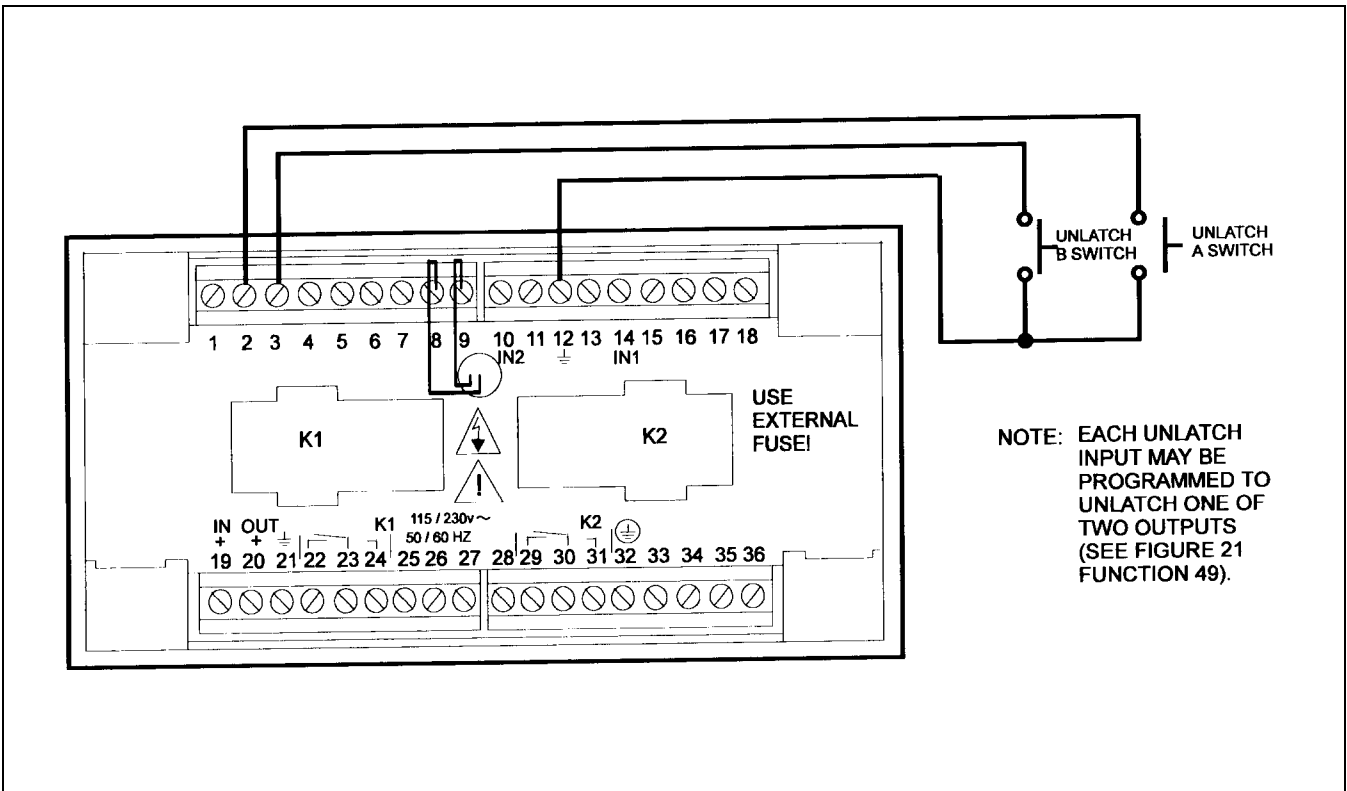


Figure 16. Latch Until Contact Closure Wiring



# INSTALLATION INSTRUCTIONS/WIRING

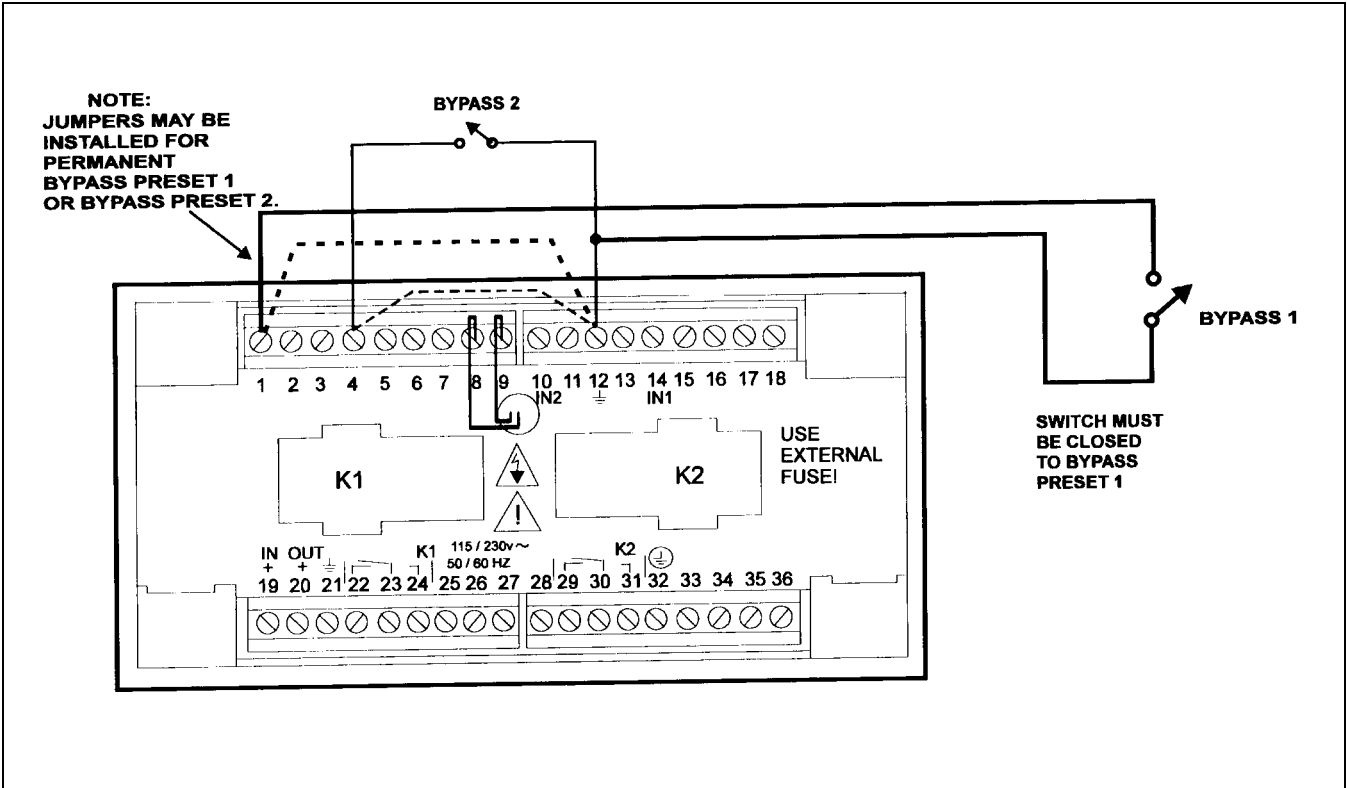


Figure 17. Bypass Preset I Input Wiring

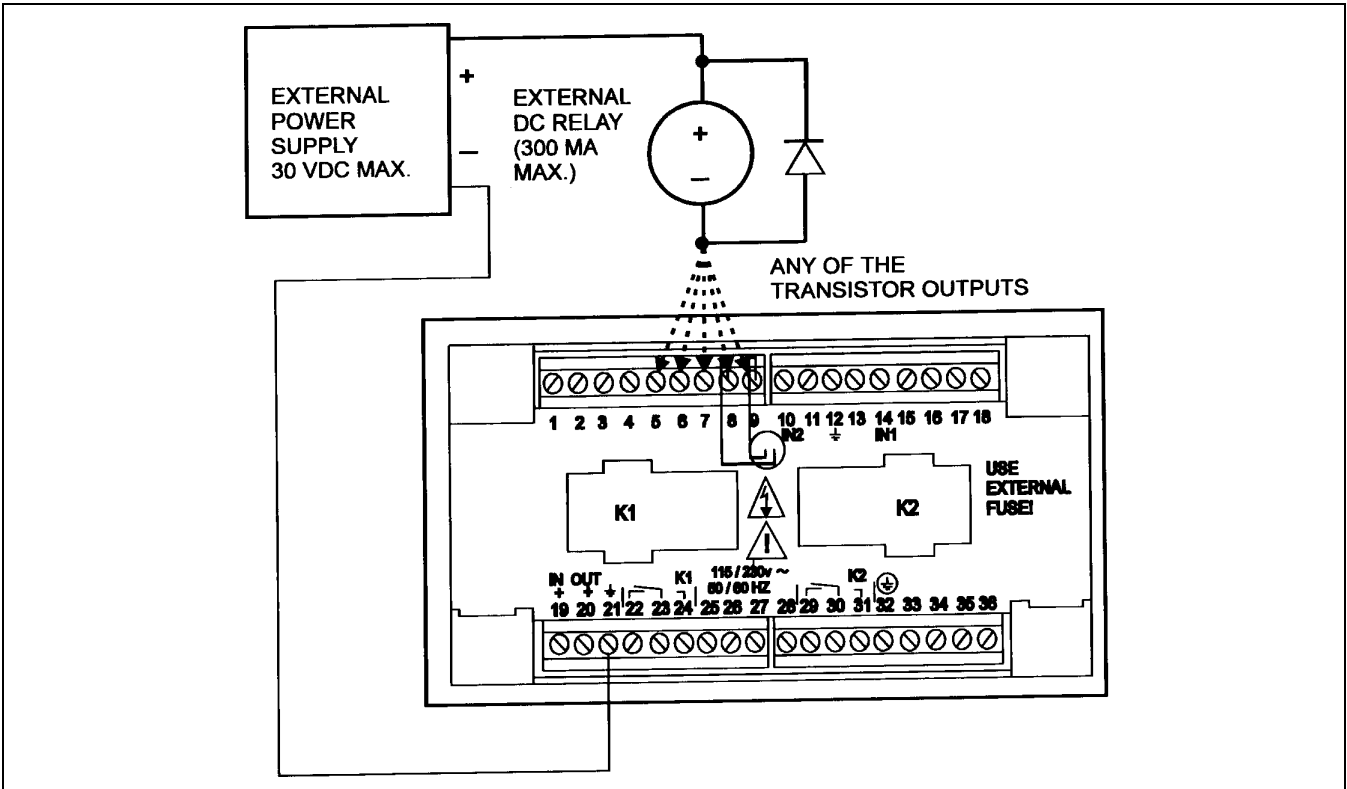


Figure 18. Using Transistor Outputs to Drive Loads

# INSTALLATION INSTRUCTIONS/WIRING

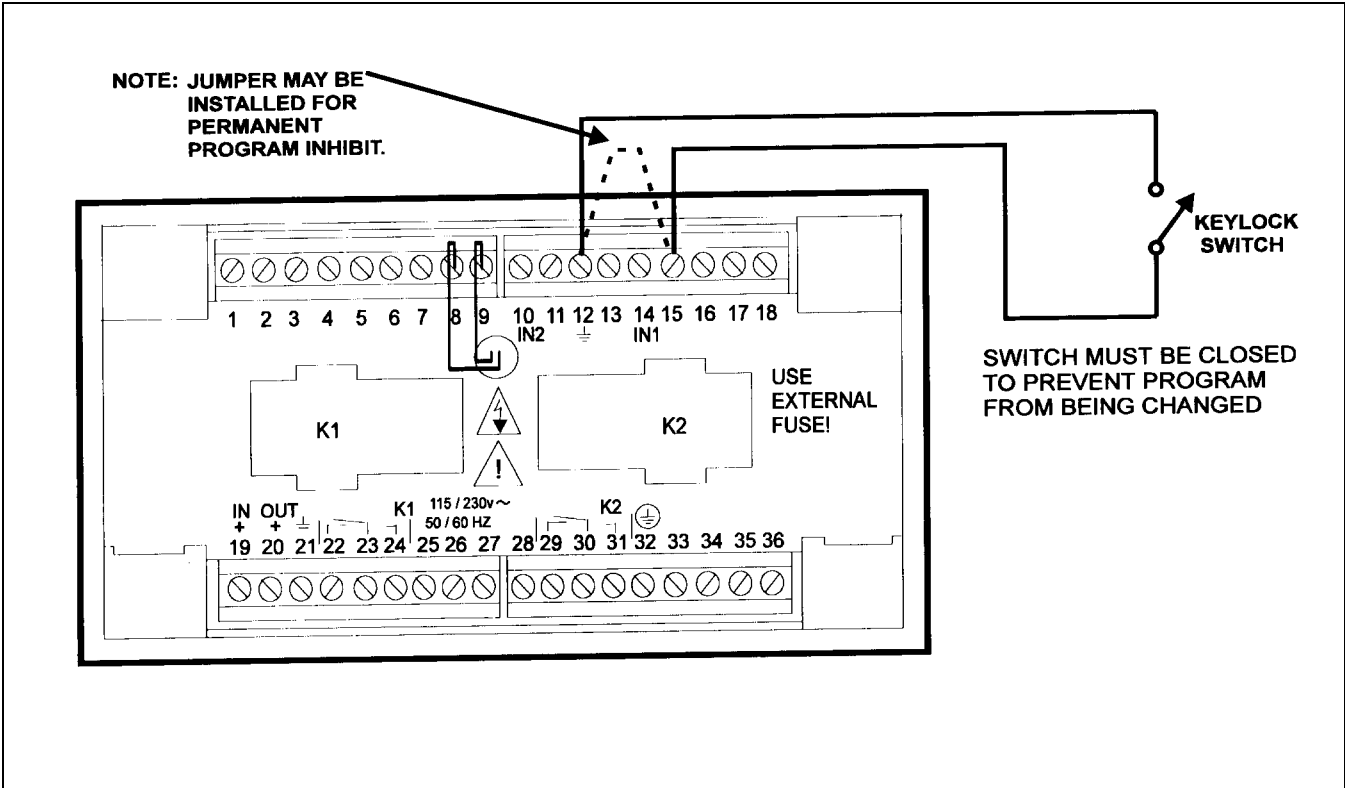


Figure 19. Program Inhibit Wiring

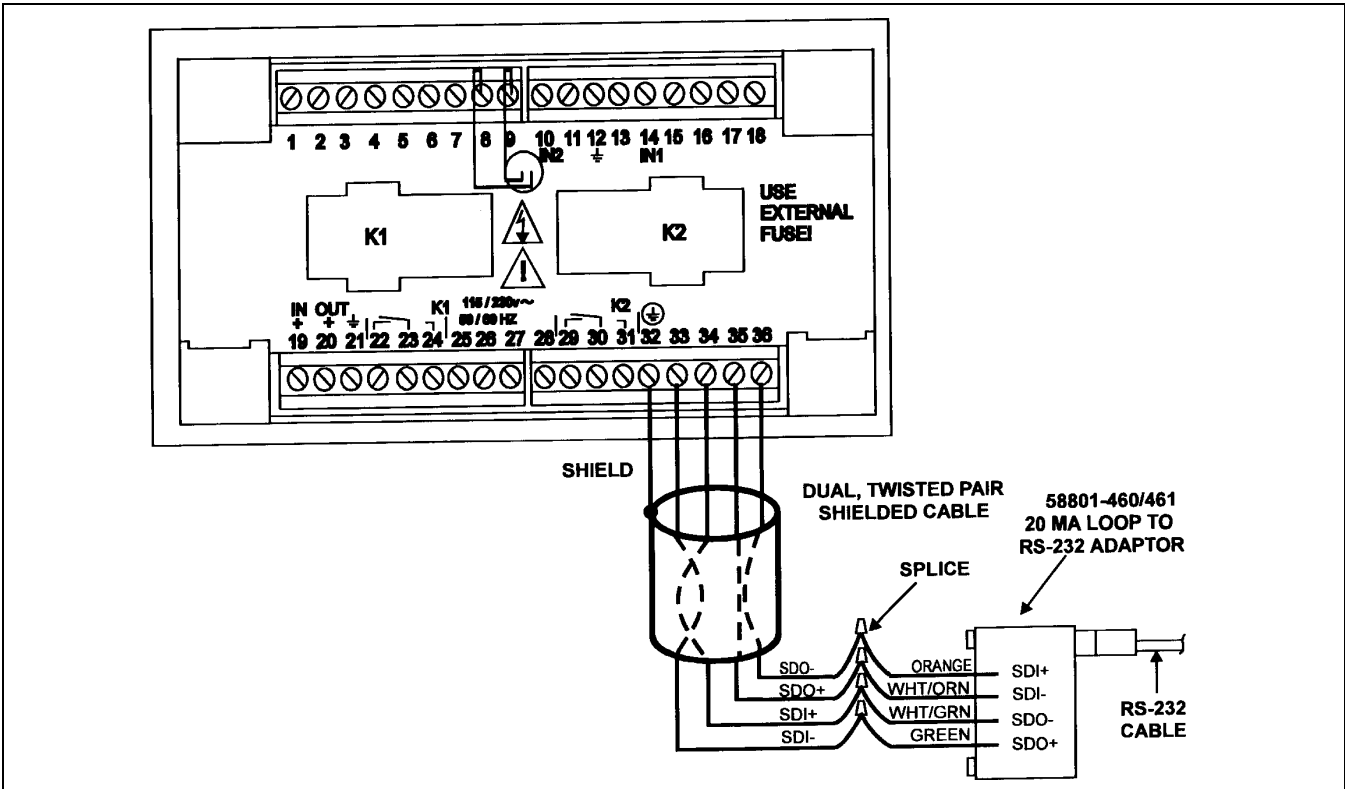


Figure 20. Serial Communications to Durant Communications Convertor

## OPERATION

---

### DISPLAY

The six-digit numeric display normally indicates the counter value. When presets or functions are being programmed, the display indicates either the function code or the data being programmed. When power is applied to the counter, the display flashes at 1/2 second intervals for 4 seconds. The counter will accept counts during this period.

### INDICATORS

Four yellow LED indicators in the form of “light-bars” are located to the right of the display. These lightbars indicate what is being displayed, the count value, preset 1 value, preset 2 value or preset 3 value. All four are off when functions are being interrogated or modified. When the count is displayed in the sequential mode, the Preset LEDs indicate which preset is currently being used.

### KEYBOARD

#### Data Entry Keys (0 through 9)

The data entry keys are used to enter preset values, function codes and parameters.

#### “PRESET 1” Key (1)

The “1” key also serves as the “PRESET 1” key. The “PRESET 1” key is used to select the Preset 1 value for interrogation or modification.

#### “PRESET 2” Key (2)

The “2” key also serves as the “PRESET 2” key. The “PRESET 2” key is used to select the Preset 2 value for interrogation or modification.

#### “PRESET 3” Key (3)

The “3” key also serves as the “PRESET 3” key. The “PRESET 3” key is also used to select the Preset 3 value for interrogation or modification.

#### “COUNT” Key

The use of this key after an interrogation or modification of an operating function will cause the count to display.

#### “FUNCTION” Key

The “FUNCTION” key is used to change the programmable functions. When this key is pressed

and followed by 2 digit code, the function to be interrogated or modified is selected.

The “FUNCTION” key permits the programming of all functions except preset values.

#### “RESET” Key

The “RESET” key is used to reset the counter. If the “Unlatch At Reset” or the “Latch Until Reset Complete” function is programmed, the “RESET” key may be used to unlatch any of the transistor outputs. If the control is in the sequential mode, the “RESET” key also resets the sequence.

#### “ENTER” Key

When the “FUNCTION” key is pressed and a code is specified, the “ENTER” key is used to terminate and enter the code. The “ENTER” key is also used to terminate and enter a programmed value or a preset value.

### FUNCTION CODES

The control has many different programmable operating modes and selectable options. The user must select which of these functions will be used and how they should operate by specifying a Function Code on the keyboard and entering the correct value choice to select the desired mode. The functions may be reprogrammed at any time if the Program Inhibit terminal (terminal #15) is not connected to the DC Common.

While the user is programming the various functions and their entry choices, the counter continues to operate normally, even though the display does not indicate the current value of the counter. This allows the operating parameters to be changed while the process being controlled is running. See Figure 22 for a complete table of the functions and their allowable entry choices.



**CHANGING FUNCTION CODE VALUES WHILE THE PROCESS IS OPERATING MAY BE HAZARDOUS TO THE OPERATOR AND/OR THE MACHINERY. USE EXTREME CAUTION. IT IS RECOMMENDED THAT THE PROCESS BE**

## OPERATION

### STOPPED BEFORE FUNCTION CODE VALUES ARE MODIFIED WHENEVER POSSIBLE.

If an invalid Function Code is specified, the control ignores the selection and displays the current count value. An invalid Function Code is any code not listed in Figure 21.

If an invalid value is entered in a Function Code, the control may ignore or modify the entry. If ignored, the previous setting is retained. An invalid value is any value other than those allowable values listed in Figure 21.

When shipped from the factory, the control is programmed with the Function Codes set as indicated in Figure 21 with asterisks (\*). When the user changes the values for any or all of the functions, the new values are stored in the nonvolatile memory of the counter. This means that the new values are permanently stored until reprogrammed, even if power fails.

If it is desired to return the control to the factory set values after being reprogrammed, enter a value of "1" in function 43.

FUNCTION	FUNCTION CODE	ENTRY CHOICES	DESCRIPTION
CURRENT COUNT VALUE	COUNT KEY	NONE	Shows current count value.
PRESET 1	PRESET 1 KEY ("1" KEY)	*0 to 999,999	Defines Preset 1 value. (Factory set value is zero.)
PRESET 2	PRESET 2 KEY ("2" KEY)	*0 to 999,999	Defines Preset 2 value. (Factory set value is zero.)
PRESET 3	PRESET 3 KEY ("3" KEY)	*0 to 999,999	Defines Preset 3 value. (Factory set value is zero.)
SCALE FACTOR (Model 5883-1400 only)	5	0.0001 to 9.9999  *1.0000	Defines scale factor value.  (Factory set value is 1.0000)
COUNT MODE	60	*0  1  1  2  3	Count with separate add (Input 2) and subtract (Input 1)  Count up (Input 1) with Inhibit control (Input 2) NOTE: This mode cannot be doubled with double input.  Quadrature NOTE: Double input MUST be connected to DC Common.  Count (Input 1) with up/down control (Input 2)  Double Quadrature NOTE: Double input MUST be connected to DC Common.

NOTE: Choices shown with asterisks are the factory set values

**Figure 21. Function Code Programming Table**

## OPERATION

FUNCTION	FUNCTION CODE	ENTRY CHOICES	DESCRIPTION
DECIMAL POINT LOCATION	62	0 1 2 3 4 5	No decimal points are displayed 00000.0 0000.00 000.000 00.0000 0.00000
TRANSISTOR OUTPUT 1 TIMEOUT	30	.00  0.01 to 99.99  10.00	No timeout. Transistor output remains on until unlatched.  Seconds of delay before transistor output unlatches.  Factory set value.
TRANSISTOR OUTPUT 2 TIMEOUT	31	.00  0.01 to 99.99  10.00	No timeout. Transistor output remains on until unlatched.  Seconds of delay before transistor output unlatches.  Factory set value.
TRANSISTOR OUTPUT 3 TIMEOUT	32	.00  0.01 to 99.99  10.00	No timeout. Transistor output remains on until unlatched.  Seconds of delay before transistor output unlatches.  Factory set value.
TRANSISTOR OUTPUT OPERATION	33	0 1 2 3 4 5 6 7	Normal Outputs. Reverse Output 1. Reverse Output 2. Reverse Output 1 and Output 2. Reverse Output 3. Reverse Output 1 and Output 3. Reverse Output 2 and Output 3. Reverse All Outputs.
UNLATCH AT ALTERNATE OUTPUTS  Proper selection of three digits, "XYZ," determines when each output will unlatch. "000" causes no latch at alternate outputs, "333" causes each output to unlatch when another output turns on.	35	"X" Value 0  1 2 3	OUTPUT 3 Output 3 does not unlatch at an alternate Output. Unlatch Output 3 at Output 1. Unlatch Output 3 at Output 2. Unlatch Output 3 at either Output 1 or Output 2.

NOTE: Choices shown with asterisks are the factory set values

**Figure 21. Function Code Programming Table (Continued)**

## OPERATION

FUNCTION	FUNCTION CODE	ENTRY CHOICES	DESCRIPTION
UNLATCH AT ALTERNATE OUTPUTS (Continued)		“Y” Value 0  1 2 3  “Z” Value 0  1 2 3	OUTPUT 2 Output 2 does not unlatch at an alternate Output. Unlatch Output 2 at Output 1. Unlatch Output 2 at Output 3. Unlatch Output 2 at either Output 3 or Output 1.  OUTPUT 1 Output 1 does not unlatch at an alternate Output. Unlatch Output 1 at Output 2. Unlatch Output 1 at Output 3. Unlatch Output 1 at either Output 2 or Output 3.
LATCH UNTIL RESET COMPLETE	36	0 1 2 3 4 5 6 7	No LURC. LURC Output 1. LURC Output 2. LURC Output 1 and Output 2. LURC Output 3. LURC Output 1 and Output 3. LURC Output 2 and Output 3. LURC All Outputs
UNLATCH AT RESET	39	0 1 2 3 4 5 6 7	No UAR. UAR Output 1. UAR Output 2. UAR Output 1 and Output 2. UAR Output 3. UAR Output 1 and Output 3. UAR Output 2 and Output 3. UAR All Outputs
PRESET LOCK (Functional only when the Program Inhibit terminal is connected to DC Common.)	41	0 1 2 3 4 5 6 7	All Presets Unlocked. Preset 1 Locked. Preset 2 Locked. Preset 1 and Preset 2 Locked. Preset 3 Locked. Preset 1 and Preset 3 Locked. Preset 2 and Preset 3 Locked. All Presets Locked.
OUTPUT UNLATCH OPERATION (Terminals 2 and 3)	49	0  1  2	A Unlatches Output 1. B Unlatches Output 2. A Unlatches Output 1. B Unlatches Output 3. A Unlatches Output 2. B Unlatches Output 3.

NOTE: Choices shown with asterisks are the factory set values

**Figure 21. Function Code Programming Table (Continued)**

## OPERATION

FUNCTION	FUNCTION CODE	ENTRY CHOICES	DESCRIPTION
RESET/PRESET MODE	80	0 1	Reset mode. Counter is reset to zero when the "RESET" key is pressed or the reset input (terminal # 17) is energized. Preset mode. Counter is reset to the Preset 3 number when the "RESET" key is pressed or the reset input (terminal #17) is energized.
AUTO RECYCLE	81	0 1 2 3 4 5 6 7	No Auto Recycle Auto Recycle at Output 1. Auto Recycle at Output 2. Auto Recycle at either Output 1 or Output 2. Auto Recycle at Output 3. Auto Recycle at either Output 1 or Output 3. Auto Recycle at either Output 2 or Output 3. Auto Recycle at Output 1, Output 2 or Output 3.
RESET INPUT MODE	82	0 1	Maintained. Counter remains reset until the Reset input is deenergized or the "RESET" key is released. Momentary. Instantaneously reset when input is energized or when "RESET" key is pressed. Then allows counter to operate normally regardless of whether reset input is held energized or "RESET" key is continuously being pressed.
SCALER RESET (Model 5886-1400 only)	83	0 1	Reset Scaler when "Reset" key is pressed or when Reset Input is energized. Reset Scaler as above or when counter performs Auto Recycle.
PRINT REQUEST/RESET COUNTER INPUT OPERATION (Terminal 16)	84	0 1	Print Request/Display Latch. Reset Counter (Functional only in sequential mode, Function code 85="4")
OUTPUT OPERATION (See Figure 3)	85	0 1 2 3 4	Independent Prewarn Output 1. Prewarn Output 2. Prewarn both Output 1 and Output 2. Sequential.
COMMUNICATIONS SPEED	90	0 1 2	100 Baud (Send and receive data at 110 bits per second.) 300 Baud 1200 Baud
COMMUNICATING TYPE Proper selection of two digits, "XY," determines the combination of values which are transmitted. "17" transmits no values.	91	"Y" Value *0 1 2 3 4	Count      Preset 1      Preset 2 ✓            ✓            ✓ ✓                       ✓            ✓ ✓            ✓ ✓ ✓            ✓

NOTE: Choices shown with asterisks are the factory set values

**Figure 21. Function Code Programming Table (Continued)**

## OPERATION

FUNCTION	FUNCTION CODE	ENTRY CHOICES	DESCRIPTION
COMMUNICATING TYPE (Continued)  (Model 5886-1400 only)		5 6 7 "X" Value *0 1 2 3	Count      Preset 1      Preset2 ✓ ✓ No Transmission of Count, Preset 1, or Preset 2. Preset 3      Scale Factor ✓ No Transmission of Preset 3 or Scale Factor. ✓ ✓
PRINT ON RESET	92	*0  1	No Print on Reset. Print when Print Request input is energized or Print Request communication (ASCII"?) is received. Print on Reset. Print when Reset input is energized. Then automatically reset. No counts are lost with the Print on Reset option.
OUTPUT 1 COINCIDENCE VALUE	96	—	Shows the coincidence value for Output 1. When in the Prewarn mode, this value may be different than Preset 1.
OUTPUT 2 COINCIDENCE VALUE	97	—	Shows the coincidence value for Output 2. When in the Prewarn mode, this value may be different than Preset 2.
SELF-DIAGNOSTIC MODE	40	*0 1	Return to normal operation. Perform self-diagnostics. Returns to "0" upon successful completion.
SELECT FACTORY-SET PARAMETERS	43	*0 1	Return to normal operation. Reset all function codes to the factory set values.

NOTE: Choices shown with asterisks are the factory set values

**Figure 21. Function Code Programming Table (Continued)**

### PROGRAMMING FUNCTION CODES

To change the operation of a function with the PROGRAM INHIBIT jumper removed, follow these steps:

1. Press the "FUNCTION" key. The display blanks indicating that the key has been pressed.
2. Select the one or two digit function code for the desired function. For example, press "30" to select the relay and transistor timeout value. The display indicates the two digits pressed for the function code. If more than two digits are pressed, the display only retains the last two digit entries.
3. Press the "ENTER" key. The current value for the specified function is displayed. If the value does not need to be changed, a new function may be chosen by returning to step 1. The "COUNT" key may also be pressed to return to the count value.
4. Press the digit keys for the desired entry. Using the above example, a value of 100 could be entered to select 1.00 second of timeout. The display shows the value as the keys are pressed.



## OPERATION

---

5. Press the “ENTER” key to store the new data. The display blanks temporarily as the control stores the information. If the entry is out of range for the selected function, the control may change the entry to a value in range.
6. The next function to be interrogated or modified may be specified. If no additional functions need to be selected, the control can be returned to displaying the current count value by pressing the “COUNT” key.

### CHANGING THE PRESET VALUES

To change the value of Preset 1, Preset 2 or Preset 3, follow these steps:

1. Press the “PRESET 1,” “PRESET 2,” or “PRESET 3” key. The display will show the current value for that preset. If the value displayed is the same as the desired value, proceed to step 4.
2. Key in the new preset value. Upon pressing the first key, the current preset value disappears and the digit which was pressed appears. Each successive digit displays as it is pressed.
3. Press the “ENTER” key. The display blanks for a moment and then redisplay the new preset. This confirms that the new value has been entered.
4. Press the “COUNT” key. The display returns to showing the current count value.
5. If other presets must be entered, return to step 1.

### PREVENTING PRESET MODIFICATION

To avoid accidental change to the preset values, it is recommended that the ability to change the Presets is inhibited whenever possible.

Function code 41, Preset Lock, allows any combination of Presets to be inhibited (see Figure 21).

Any Presets selected in Function code 41 cannot be changed when the Program Inhibit Input is energized (see “Inhibiting Programming Modifications” below).

### DISABLING THE FRONT PANEL RESET KEY

Select the Momentary Reset mode (enter “1” in function 82) and install a jumper from the reset input (terminal #17) to DC Common. This disables the Front Panel Reset key and prevents the operator from accidentally resetting the counter.

The jumper may be replaced by a normally closed contact. In this case the counter is reset externally by opening and closing this contact.

If power is interrupted, the counter is not reset when power is reapplied.

### INHIBITING PROGRAMMING MODIFICATIONS

The function codes and their values may be accessed and modified whenever the control has power applied, including times when the process being controlled is running.



**CHANGING FUNCTION CODE VALUES WHILE THE PROCESS IS OPERATING MAY BE HAZARDOUS TO THE OPERATOR AND/OR THE MACHINERY. USE EXTREME CAUTION. WHENEVER POSSIBLE, STOP THE PROCESS BEFORE ATTEMPTING TO MODIFY FUNCTION CODE VALUES.**

To avoid accidental change to the function code values, it is recommended that the ability to change them be removed by installing a jumper between the PROGRAM INHIBIT terminal and DC Common on the rear of the control. When installed, all of the functions may be interrogated but not modified.

## SCALE FACTORS

The Model 5886-1400 Control includes the ability to scale incoming counts. This means that for each pulse received on the count inputs, a fraction or multiple of that pulse is counted. Scaling can be used to compensate for wear on measuring wheels, consistent material slippage or material

stretch, to make conversions between different units of measure (inches to centimeters, for example) or to totalize parts produced from multiple part manufacturing processes (such as 6 parts produced for each operation of a press).

SCALE FACTOR	COUNT SPEED (PULSES PER SECOND)	
	Normal Count	Quadrature and/or Doubled Count
0.0001 to 0.9999	5,000	2,500
1.0000	7,500	3,750
1.0001 to 1.9999	4,000	2,000
2.0000	6,000	3,000
2.0001 to 2.9999	3,500	1,750
3.0000	5,000	2,500
3.0001 to 3.9999	3,000	1,500
4.0000	4,000	2,000
4.0001 to 4.9999	2,750	1,375
5.0000	3,500	1,750
5.0001 to 5.9999	2,500	1,250
6.0000	3,000	1,500
6.0001 to 6.9999	2,250	1,125
7.0000	2,500	1,250
7.0001 to 7.9999	2,000	1,000
8.0000	2,250	1,125
8.0001 to 8.9999	1,750	875
9.0000	2,000	1,000
9.0001 to 9.9999	1,500	750

**Figure 22. Table of Scale Factors versus Count Speed**

The scale factor can be a number from 0.0001 to 9.9999. This number becomes a factor by which incoming count pulses are multiplied. The sum of the scaled count pulses is shown on the front panel display.

### ENTERING A SCALE FACTOR

Function 5 selects the Scale Factor. Note that any jumper connected to the Program Inhibit terminal on the rear panel of the counter must first be disconnected before the Scale Factor may be modified. To change the Scale Factor, follow these steps:

1. Press the "FUNCTION" key. The display blanks to indicate that the key has been pressed.
2. Press the "5" key. The display indicates this digit.
3. Press the "ENTER" key. The current value for the Scale Factor is displayed. If the value does not need to be changed, proceed on to step 6 below.
4. Press the digit keys for the desired entry. Note that for a Scale Factor of 1 the entry of 10000

## SCALE FACTORS

must be made since the scale factor is displayed in the X.XXXX format. The display shows the value as each key is pressed.

5. Press the "ENTER" key to store the new data. The display blanks momentarily as the control stores the information. If a zero is entered as the Scale Factor, the counter defaults to the value of 1.0000.
6. The next function to be interrogated or modified may be specified. If no additional functions need to be selected, the counter may be returned to displaying the current count value by pressing the "COUNT" key.

### COUNT SPEED VERSUS SCALE FACTOR

The scale factor entered into the counter has a direct effect on the maximum rate at which the counter can receive count pulses. Generally, the larger the scale factor the slower the counter can receive pulses. A table indicating count speed versus scale factor values is given in Figure 23.

In this table, the Normal Count columns represent the speed at which the counter can receive pulses when it is operating in the Add/Subtract, Count with Direction Control or Count Up with Inhibit Control modes. The Quadrature and Doubled Count columns indicate speed whenever the hardware doubling (jumper installed between the Double Input and DC Common) is utilized.

### OPERATION OF THE SCALER

When the counter receives a count pulse, the scaler recognizes that fact and multiplies the 1 pulse by the scale factor. The scaled value, which will be a number from 0.0001 to 9.9999 since this is the range of the scale factor, is added to a resultant total. This resultant is shown on the display. However, the result can have up to four decimal places of value. The display only shows whole increments of counts.

For example, a scale factor of 1.2000 is entered into the counter. For each pulse received 1.200 is added to the result. But since the display only indicates whole numbers, after the first pulse it shows "1". After 5 pulses it shows "6". This is shown in Figure 23.

PULSES RECEIVED	RESULT CALCULATED	DISPLAY VALUE
0	0.0000	0
1	1.2000	1
2	2.4000	2
3	3.6000	3
4	4.8000	4
5	6.0000	6
6	7.2000	7
7	8.4000	8
8	9.6000	9
9	10.8000	10
10	12.0000	12

**Figure 23. Pulses Received versus Displayed Value Using Scale Factor of 1.2000**

The scaler stores any remaining partial count and adds that to the next scaled pulse value when it is received. This allows accumulation of scaled partial counts.

When a Preset is established on a control with scaling, the control activates the related output as shown in Figure 3. But when scaling is used, the count value is not necessarily a whole number. The partial count remainder can affect when the output(s) change state.

With the example of Figure 23, a Preset of 11 is entered into the control. After the first pulse the display shows 1 and after the ninth pulse it shows 10. But, the next pulse changes the display to show 12, bypassing the preset of 11. The counter, during the process of adding the scaled result to the total, actually counts from 10 through 11 to 12. This occurs so swiftly that the value of 11 cannot be seen on the display. However, the counter does recognize coincidence at the value of 11 and changes the state of the output.

As a second example, a Scale Factor of 0.5000 is entered into the control. Figure 24 gives a table of pulses received versus displayed value for this example.

A Preset of 5 is entered when the control is in the independent output mode. From Figure 24, it is evident that the output will turn on when the 10th

## SCALE FACTORS

PULSES RECEIVED	RESULT CALCULATED	DISPLAY VALUE
0	0.0000	0
1	0.5000	0
2	1.0000	1
3	1.5000	1
4	2.0000	2
5	2.5000	2
6	3.0000	3
7	3.5000	3
8	4.0000	4
9	4.5000	4
10	5.0000	5
11	5.5000	5
12	6.0000	6
13	6.5000	6
14	7.0000	7
15	7.5000	7
16	8.0000	8

**Figure 24. Pulses Received versus Display Value Using Scale Factor of 0.5000**

pulse is received on the count input. It is when the 10th pulse is received that the display changes from 4 to 5. However, if the counter is used in the Reset to Preset mode, the display shows 5 when the Reset key is pressed. The first pulse received changes the display to show 4, and the ninth pulse changes the display to 0. But, it is the TENTH pulse that causes the output to change state. This is because after the ninth pulse, there is a remainder of 0.5000 counts in the counter and, therefore, the value in the counter is not actually zero until after the next pulse.

### HOW SCALE FACTORS AFFECT PROCESSES

When the use of Scale Factors results in partial count remainders, those remainders can affect the manner in which the process being controlled will function. For example, if a Scale Factor of 1.3000 is entered into a control and a Preset of 15 is used in the independent mode, a table as shown in Figure 25 results.

The control is used in the Reset mode. When reset, the counter starts at zero and counts to the Preset value. If the Auto Recycle mode is implemented, the counter recycles when the Preset value is reached. But, with a Preset of 15, the counter has actually accumulated 15.6000 counts.

Thus, when it recycles, a value of 0.6000 counts remains. When the next pulse is received, 1.3000 counts is added and the count value is 1.9000. The "Second Cycle Display" column shows the displayed value for the second cycle.

It is obvious from the last column that slightly more counts are accumulated for the second part than were accumulated for the first. If this table were carried out for the third part, we would find that the third part is cut off one pulse too early. Clearly, the carryover of the remaining partial count causes problems in these types of applications.

As a solution, a function code has been provided which allows the choice of whether the remaining partial count is carried over into the next cycle or not. Function 83, Scaler Reset on Recycle, allows selection of this option. If function 83 has a value of "0" entered, the scaler is not reset when an Auto Recycle occurs. If a value of "1" is entered, the scaler is reset each time an Auto Recycle occurs. This forces any remaining partial count to be reset to zero, eliminating the problem described above. The unit is shipped from the factory with the Scaler Reset on Recycle Mode enabled (Function 83 has a value of "1").

It should be noted that the remaining partial count is typically an extremely small part of the total length of the part being produced (typically less than 1%). In those applications where the measurement system may be chosen, the rule of thumb is that the measurement device should have a minimum of twice the resolution (generate at least twice as many pulses per unit of measure) as the desired part accuracy.

For example, if a 10.00 inch part is to be made and the tolerance of the part may be plus or minus 0.02 inches, the measurement system should generate at least one pulse for each 0.01 inches of material being measured. Thus, after the display shows 10.00 inches (1000 counts), there may be a remaining partial count of 0.400 due to the use of a Scale Factor. The percentage of error is calculated by  $0.400/1000$ . This yields 0.04% error.

Even though the error is so small, compensation should still be made for the extra partial count at the end of a part by entering a "1" in Function 83. This is because the error is cumulative; that is,

## SCALE FACTORS

PULSES RECEIVED	RESULT CALCULATED	DISPLAY VALUE	SECOND CYCLE RESULT	SECOND CYCLE DISPLAY
1	1.3000	1	1.9000	1
2	2.6000	2	3.2000	3
3	3.9000	3	4.5000	4
4	5.2000	5	5.8000	5
5	6.5000	6	7.1000	7
6	7.8000	7	8.4000	8
7	9.1000	9	9.7000	9
8	10.4000	10	11.0000	11
9	11.7000	11	12.3000	12
10	13.0000	13	13.6000	13
11	14.3000	14	14.9000	14
12	15.6000	15	16.2000	16

**Figure 25. Pulses Received versus Display Value Using Scale Factor of 1.3000**

each successive part grows longer by 0.004 inches. Eventually, this cumulative error will cause the part to be out of tolerance.

Typically, those applications which require Function 83 to have a value of "1" are cut-to-length applications. When the application is performing a repetitive process such as punching equally spaced holes in a single part, the scaler should retain partial counts for the next measurement. In these cases, Function 83 should be set to "0". Whenever the Reset key is pressed or the Reset Input is energized, the scaler is always reset, eliminating any remaining partial counts. This is regardless of the value entered in Function 83.

### CALCULATING THE SCALE FACTOR

There are four general categories of applications which require scaling. The method of calculating the scale factor differs for each. The categories are:

1. Allowances for wear of measurement devices and material stretch applications.
2. Unit conversions (typically when the measurement system is set up for measuring one unit and the part must be made in another; i.e., inches versus millimeters.)
3. Scaling of pulses received from flowmeters or other sensors which produce a non-standard number of pulses per unit of measure.

4. Allowing multiple parts to be made for each operation of a machine.

A discussion of the means of calculating the scale factor for each category and special problems involved follows.

### Allowances for Wear or Stretch

Over a period of time a measuring wheel will begin to wear. The wheel allows accurate measurement only when its circumference is a known, fixed value. Thus, as the wheel wears, the error in the measurement increases because the circumference of the wheel becomes less and less. Scaling provides a means to compensate for the decreasing wheel circumference. This allows the useful life of the measuring wheel to be extended, decreasing cost.

In applications where the material stretches or shrinks by a fixed amount, scaling allows compensation for gained or lost material. These applications required that the amount of stretch or shrinkage be known, measurable or calculable and that it be consistent from machine cycle to machine cycle.

In either case, the scale factor is calculated by using the formula:

$$\text{Scale Factor} = \frac{\text{Measured or Calculated Distance}}{\text{Theoretical Distance}}$$

## SCALE FACTORS

In the above formula, the Theoretical Distance is the distance that would be measured if the measuring wheel were new or within design tolerance of new. For stretch or shrinkage applications, it is the amount of material fed into the process before the stretching or shrinkage occurs. The Measured or Calculated Distance is the length which results upon completion of the part or process. For example, if the counter is intended to produce 12.00 inch parts but the parts come out of the machine only 11.93 inches long, the Measure distance is 11.93 inches. (The Theoretical Distance in this example is 12.00 inches.) Figure 26 shows graphically what takes place in this application.

The shaft encoder in Figure 26 produces 600 pulses per revolution. Doubling is used in the counter to result in 1200 pulses per revolution. The measurement wheel is intended to have a 12.00 inch circumference. This should result in 1 pulse per 0.01 inches. Since a 12.00 inch is desired, a Preset of 1200 is entered into the counter with a scale factor of 1.0000.

However, when the process is run, the parts consistently come out of the machine only 11.93

inches long. The counter is counting 1200 pulses and the output of the counter is energized at that time. Obviously, the wheel is not the 12.00 inch circumference which it should be. Rather than replacing the measurement wheel, a scale factor can be entered to compensate for the discrepancy. Using the formula on the previous page, the scale factor is calculated by:

$$\text{Scale Factor} = \frac{11.93'' \text{ (Measured)}}{12.00'' \text{ (Theoretical)}} = 0.9942$$

With this scale factor entered, the display still shows 12.00 counts for each part, but each pulse received is worth only 0.9942 counts. Thus, more than 1200 pulses are received by the counter for each part being produced and the part is made to the correct length.

For applications where the material is stretched or shrunk, the measurement device may be located on the front end of the process where the unaffected material is fed in. Yet the counter can have a scale factor entered which allows it to measure the finished parts. Figure 27 shows a typical process which results in material stretch.

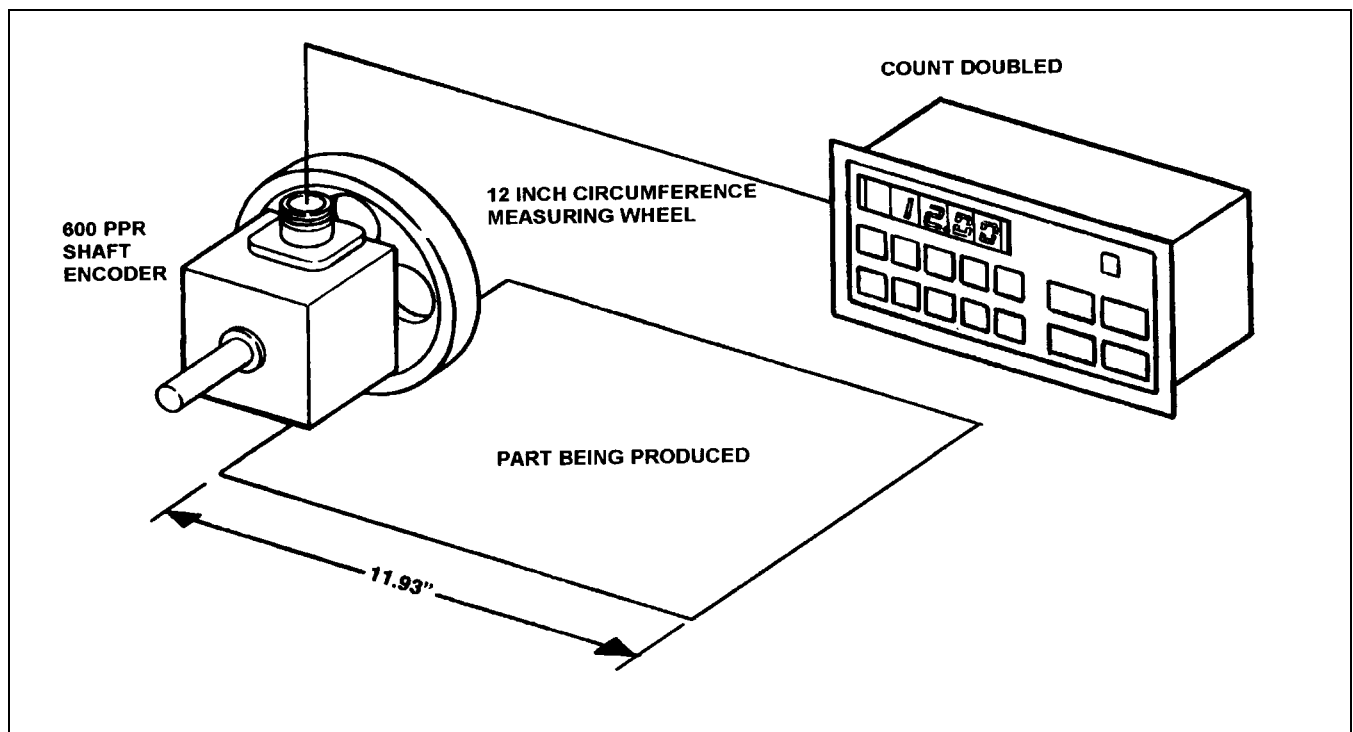


Figure 26. Wheel Wear Correction Application

# SCALE FACTORS

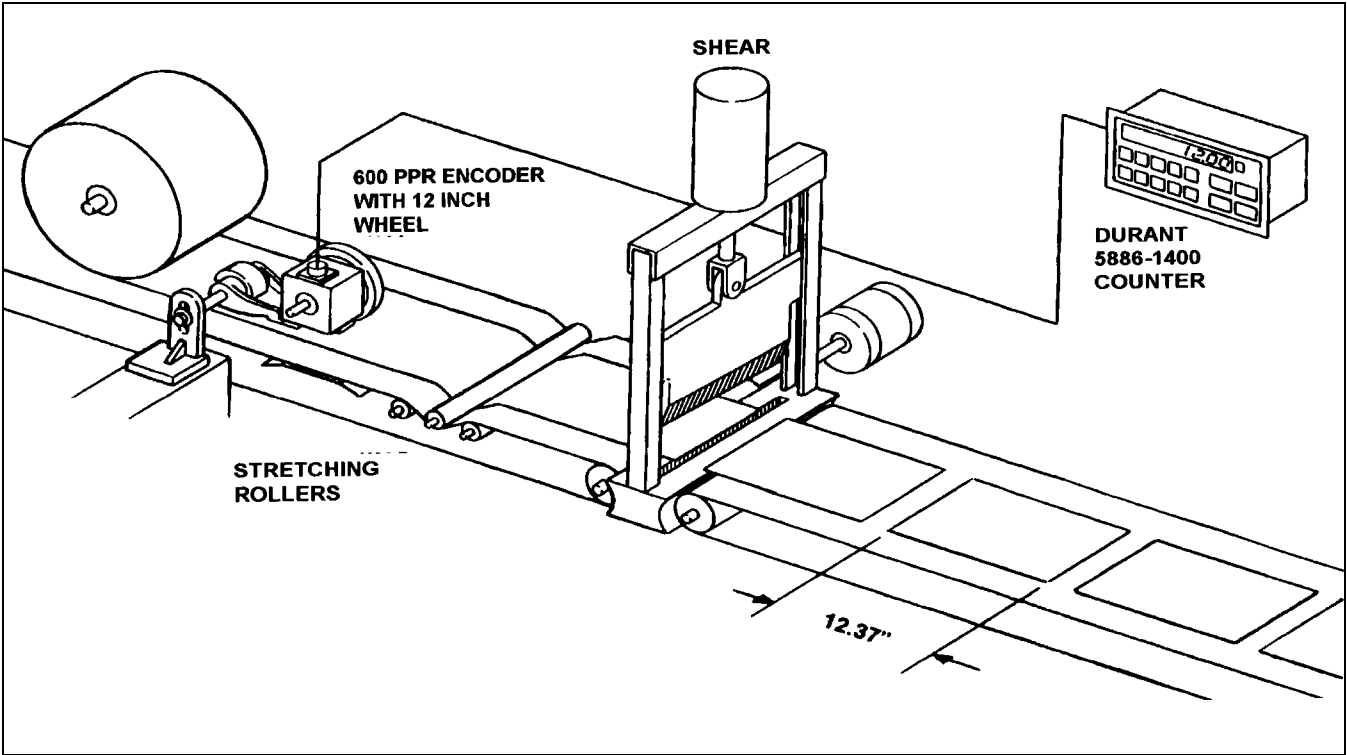


Figure 27. Material Stretch Application

Again, a 12.00 inch part is desired. A Preset of 12.00 is entered into the control with a scale factor of 1.0000 and a sample part is produced. When it is measured, it is found to be 12.37 inches long. The scale factor needed to produce a 12.00 inch part is calculated by plugging these values into the formula:

Scale Factor =  $\frac{12.37'' \text{ (Measured)}}{12.00'' \text{ (Desired)}} = 1.0308$

When the scale factor of 1.0308 is entered into the control, parts are produced at 12.00 inches as desired. Since the material is stretched in the process, each pulse received by the counter is worth 1.0308 counts. Thus, less than 1200 pulses need to be received to produce each 12.00 inch finished part and display 1200 counts.

MEASUREMENT SYSTEM MEASURES IN:	DISPLAY MUST SHOW QUANTITY IN:	SCALE FACTOR TO BE USED:
Inches	Centimeters	2.5400
Centimeters	Inches	0.3937
Feet	Yards	0.3333
Yards	Feet	3.0000
Feet	Meters	0.3048
Yards	Meters	0.9144
Meters	Feet	3.2808
Meters	Yards	1.0936
Gallons (US)	Liters	3.7854
Gallons (Imp.)	Liters	4.5428
Liters	Gallons (US)	0.2642
Liters	Gallons (Imp.)	0.2201
Quarts (US)	Liters	0.9463
Liters	Quarts (US)	1.0567

Figure 28. Unit Conversion Scale Factors

## SCALE FACTORS

---

### Unit Conversions

In some cases, the measurement system is set up to measure in one engineering unit but the parts made are produced in a different engineering unit. This may be the difference between ounces and gallons, inches and feet, feet and yards, inches and millimeters, quarts and liters or any other combination. In these applications, the scale factor may be chosen from the table given in Figure 28 or calculated using any standard conversion factor carried out to four decimal places.

### Scaling Pulses Received From Flowmeters or Other Sensors

Typically, flowmeters generate large numbers of pulses for each unit of measure. Additionally, the number of pulses per unit is usually not easily divisible or massaged to allow a standard counter to increment in a common engineering unit.

The scale factor to be entered into the counter is easily calculated by using the formula:

$$\text{Scale Factor} = \frac{1 \text{ (Unit of Measure)}}{\text{Pulses Produced per Unit of Measure}}$$

For example, a flowmeter might produce 146 pulses per gallon of flow. If the counter is to count gallons of flow, the incoming pulses must be divided by 146. If the display should indicate whole gallons of flow accumulated, the scale factor is determined by:

$$\text{Scale Factor} = 1 / 146 = 0.0068$$

If the display should rather show gallons and tenths of gallons, the scale factor may be multiplied by 10 to yield 0.0685. (Note that in this case the decimal point on the counter should be placed between the first and second digits for proper indication of units.)

When the output from other sensors must be scaled, the same formula can be used to calculate the scale factor. It is sometimes easier to change the definition of the terms in order to find the scale

factor, however. For example, a quadrature shaft encoder which produces 600 pulses per revolution is used to indicate rotation of a shaft. Usually, rotation is given in degrees with 360 degrees per revolution. If the doubled Quadrature count mode is used, 1200 pulses per revolution are received by the counter. This results in 3.3333 pulses per degree of rotation.

Given this information, finding the scale factor necessary for proper operation can be confusing. But if the terms of the formula are changed as:

$$\text{Scale Factor} = \frac{\text{Desired Display Value}}{\text{Actual Pulses Received}}$$

Filling in the terms the scale factor is found by:

$$\text{Scale Factor} = \frac{360(\text{Counts Per Revolution})}{1200(\text{Pulses Per Revolution})} = 0.3000$$

With the Scale Factor of 0.3000, the display will indicate 360 degrees per revolution from a 1200 PPR encoder.

### Allowing Multiple Parts per Machine Operation

If a single machine operation causes one pulse to be received by the counter and that single machine operation produces several parts simultaneously, the scale factor is simply the number of parts produced per pulse. For example, if six parts are produced per cycle of the machine, a scale factor of 6.0000 should be entered into the control.

In this example, if one of the six cavities requires repair and is not producing parts, the scale factor may be reduced from 6.0000 to 5.0000. This adjustment can be made without resetting the counter. The machine must be stopped, the Program Inhibit jumper removed if installed, and the Scale Factor changed. Then the Program Inhibit jumper may be reinstalled and the process started up again. This allows in-process service and adjustment of machine malfunctions without losing track of how many parts have been produced so far.



## SCALE FACTORS

---

It may be desirable in this type of application to have the Program Inhibit terminal wired to a key-lock switch, allowing easier adjustment when needed.

An additional consideration in this application is that even if the Preset is set as a multiple of six

and only five parts are made per cycle, the Preset does not need to be adjusted. This is true because the counter checks the preset for each of the five increments per cycle individually and will energize the output when coincidence is established. However, in this example, up to four extra parts may be produced when the output is energized.

## SERIAL COMMUNICATIONS

---

Several types of information may be transmitted or received by the control. The serial communications capability allows any combination of count and preset values to be printed, remotely displayed, or sent to a host computer or other peripheral device for processing. The characteristics of the communication are controlled by function codes.

### COMMUNICATION FORMAT

The control uses a **20 milliamp current loop** type of electrical interface for serial communications. The control has a separate 20 milliamp current loop for incoming communications and another loop for outgoing communications.

Since serial communication (either in or out) is done through only two wires, each character transmitted or received must be generated by a series of on and off states called bits. Each character has its own unique code or sequence of bits that allows the receiving device to understand what character it is receiving. The character "5", for example, has a series of bits which are different from the series of bits for the character "6". In fact, eight individual bits are needed to express a single character. **Seven bits** identify the character itself and the eighth is used for error checking to allow the receiving device to make sure that the previous seven are correct when they are received. This eighth bit is called the parity bit and shows "**even parity**" to the receiving device when transmitting data. When the counter receives serial data, it ignores the parity bit.

There are several different standard rates at which serial communications occur. Each is a function of the number of bits transmitted per second. The term which defines transmission rate is "Baud" which is understood to mean "bits per second."

The standard transmission rates the control can be set up to use are **110 Baud, 300 Baud, and 1200 Baud**.

While each character requires eight individual bits to be uniquely expressed, a few additional bits must be sent between characters. These are called "start" and "stop" bits. The "**start**" bit signifies that this is the beginning of the character and the next eight bits are the character itself. After the

character is transmitted, either **one or two "stop" bits** are sent to indicate that the character has been completely transmitted. When the control is operating at 110 Baud, two "stop" bits are sent and at 300 or 1200 Baud one is sent. Thus, at 300 Baud, for example, each character requires ten bits to be transmitted: one "start" bit, eight data bits and one "stop" bit. If information is being communicated at 300 Baud, 30 characters per second are communicated since a total of ten bits per character are required.

The standard set of codes used by the control for communicating information serially is called the **ASCII** character table. **ASCII** stands for American Standard Code for Information Interchange. The control uses **ASCII** codes for all its communications.

A typical character transmitted or received is shown in Figure 30. In this figure, the character is shown with the "start" bit, seven data bits, the even parity bit, and one "stop" bit.

### SENDING DATA

Data transmission can be initiated by either of two methods. The first is by connecting the PRINT REQUEST terminal (terminal #16) to DC Common. The second is by a special code transmitted to the control via the serial communications.

Once a transmission has been initiated, the counter will first transmit the "Carriage Return" and "Line Feed" characters (described in the following paragraphs and illustrated in Figure 30) followed by the numeric information selected for printing. The "Carriage Return" and "Line Feed" characters cause the printer to provide spacing between printouts.

When the control transmits the actual value or either preset value through the SERIAL DATA OUTPUT (SDO) terminals, it sends the characters "0" through "9" as necessary to express the value. It transmits the most significant digit (**MSD**) **first**. For example, if the current value of the counter is 1357, the control sends the ASCII code for "0" since the most significant digit is blank and has a value of zero, then the code for "1", then the code for "3", then "5", and finally "7".

# SERIAL COMMUNICATIONS

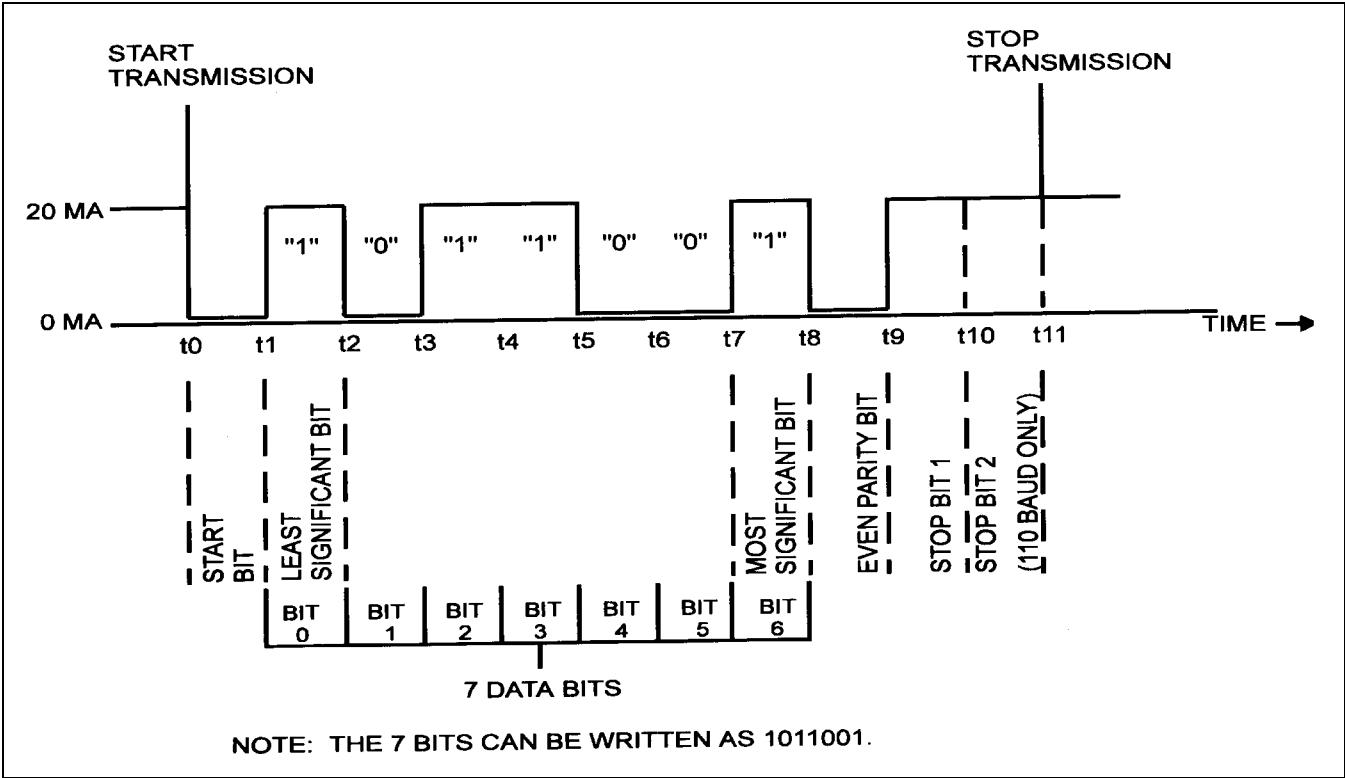


Figure 29. Organization of Typical Serially Transmitted Character

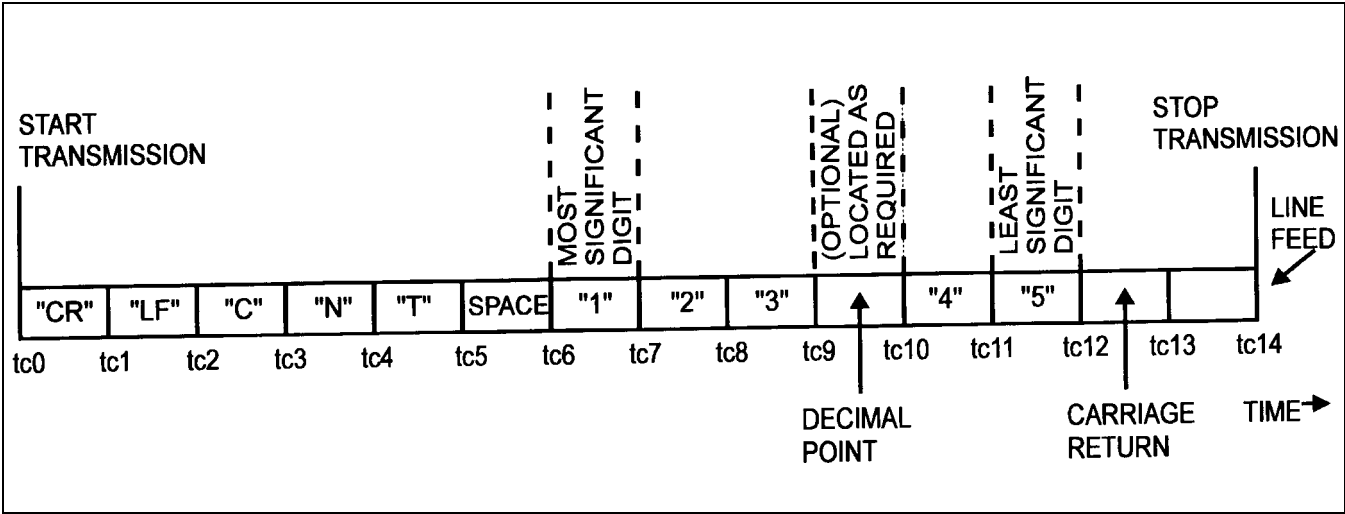


Figure 30. Serial Transmission of a Complete Value, Including "CNT" Label, Value, "CR" and "LF"

After the entire value has been transmitted, the control sends two more characters. These are called "Carriage Return" (CR) and "Line Feed" (LF). A printer, host computer or other peripheral uses these characters to identify when a transmission is complete. In the case of the printer, the "CR" instructs it to return the printing carriage and

the "LF" tells it to advance the paper one line. The "CR" and "LF" are transmitted after each value the control sends.

By selecting the associated value for the Communications Type function (Function 91) the control can transmit the counter value or any combination

# SERIAL COMMUNICATIONS

of preset values. Before the value(s) are sent, the control sends an identifier which indicates what information is to follow. When the control is connected to a printer, these identifiers are also printed. The label "CNT" is printed before the value of the counter, "PS1" is printed before the Preset 1 value, "PS2" is printed before the Preset 2 value and "PS3" is printed before the Preset 3 value. If a decimal point has been specified by programming Function 62, the decimal point is inserted into the printout at the appropriate place.

Figure 30 shows graphically how a typical value is transmitted. Each block shown consists of the bit organization as indicated in Figure 29.

Figure 31 shows a sample printout when the control has been set up to print both the counter and preset values with a decimal point before the second digit.

If the count value and both preset values are to be transmitted, the count value is always transmitted first, Preset 1 second, Preset 2 third, and Preset 3 last.

The control can be programmed to automatically transmit its values when reset. This mode is selected by entering a "1" in Function 92. Upon pressing the "RESET" key or having the Reset input energized, the control internally stores the count value, then resets the counter. Once the control is reset, the stored count value is transmitted. This allows the count value to be recorded while the process is running without losing any counts.

CNT	1234.56
PS1	5000.00
PS2	9738.15
PS3	0050.00

Figure 31. Typical Printout of Transmitted Values

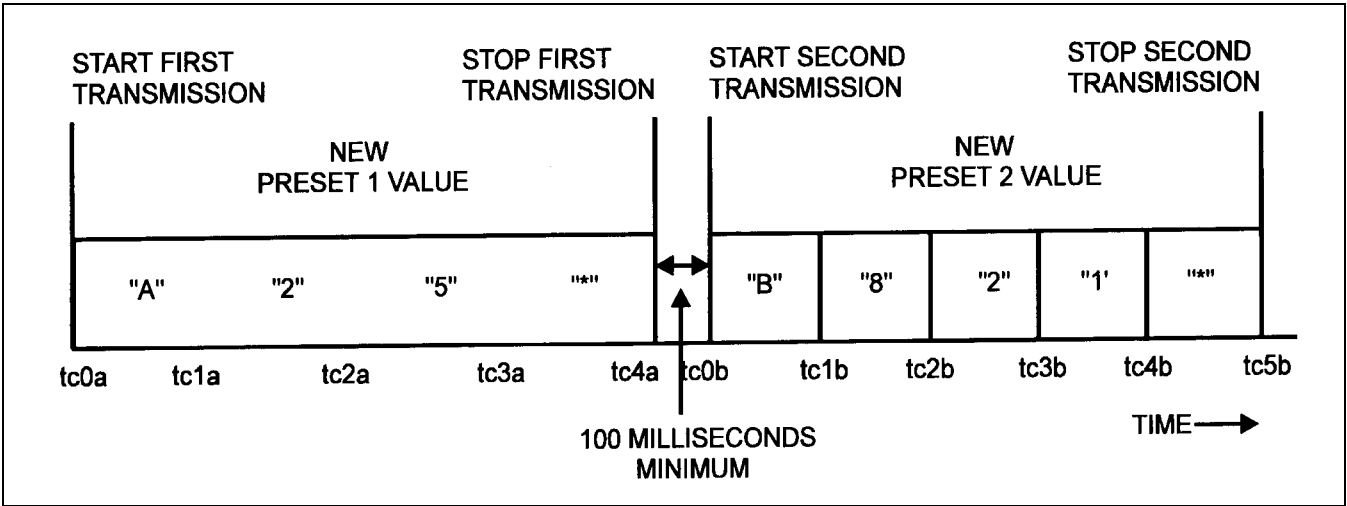


Figure 32. Typical Preset Change Serially Communicated

When the Print on Reset mode is selected, the Print Request input may be energized or the ASCII "2" received through serial communication to cause a printout without resetting the counter.

## RECEIVING DATA

The control can receive a command through the serial communications input which instructs it to automatically transmit the information of the counter or presets (depending on Function 91).

This command has the same effect as energizing the Print Request input. The ASCII character "2" asks the control to send its data.

In addition, the preset values can be changed through the serial communication input when a new value is received from a remote preset peripheral, a host computer or another compatible peripheral. The new Preset 1 value must be preceded by the ASCII character "A" which informs

# SERIAL COMMUNICATIONS

the control that a new Preset 1 value is forthcoming. The ASCII character “B” must precede the new Preset 2 value. The ASCII character “C” must precede the new Preset 3 value. After the 1 to 6 digits for the new preset are received, the ASCII character “\*” must be received to tell the control that the end of the preset value has been received. When the “\*” is received, the new preset is automatically entered.

Sample commands to change both Preset 1 and Preset 2 via serial communications is shown in Figure 33. Note that each block shown contains the bit organization as indicated in Figure 31. A minimum of 100 milliseconds must be allowed between transmissions for proper operation.

The Baud rate of the incoming serial communications is the same rate as set for the outgoing communications. Any serial data the control receives is ignored if it is not either preceded by an “A”, “B” or a “?”. The control ignores any decimal points which are received during a transmission of a new preset, but inserts the decimal point automatically after the new preset has been entered upon receipt of the “\*”.

## TRANSMITTING SCALE FACTORS

For Model 5886-1400, the Scale Factor can be

transmitted with the other values (see Figure 22). When the Scale Factor is transmitted, the value is preceded by the identifying label “SCA”, indicating Scale Factor. A sample printout of all values from a model 5886-1400 control is given in Figure 33.

CNT	001567 (Count Value)
PS1	010000 (Preset 1 Value)
PS2	025000 (Preset 2 Value)
PS3	000000 (Preset 3 Value)
SCA	1.0000 (Scale Factor)

**Figure 33. Sample Printout of Values from a 5886-1400**

## RECEIVING SCALE FACTORS

For Model 5886-1400 the Scale Factor can be received with the other values. In this case, the Scale Factor must be preceded by an ASCII “S”. The scale factor itself can be up to five digits long in ASCII characters and followed by an ASCII “\*” For example, a scale factor of 5.0000 is transmitted as “S50000\*”.

## PRINT ON RESET

The control may be programmed to print when reset. Function code 92 is used to select this mode. Print on reset does not occur when the control auto-recycles.

## TROUBLESHOOTING

### GENERAL

Most problems encountered when applying the control are due to wiring errors, improperly set Function codes, and sensors which are not correctly installed. This section provides guidelines for the detection and correction of these types of problems. Additionally, a description of the diagnostic program included in the control is discussed.



### CAUTION

**BEFORE APPLYING POWER TO THE EQUIPMENT, RECHECK ALL WIRING TO INSURE PROPER CONNECTIONS. MAKE SURE THE AC LINE VOLTAGE IS CONNECTED ONLY TO SCREW TERMINALS #25, #26, #27 AND #28. CONNECTING AC POWER TO ANY OTHER SIGNAL TERMINALS WILL CAUSE SEVERE DAMAGE TO THE CONTROL.**

PROBLEM	POSSIBLE CAUSES	REMEDIES
Display does not light when AC power is turned on.	<ol style="list-style-type: none"> <li>1. No power applied on terminals #25, #26, #27 and #28.</li> <li>2. Terminals #25, #26, #27 and #28 improperly jumpered.</li> <li>3. Short between terminals #19 or #20 and DC Common.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check wiring, fuses and primary AC power source.</li> <li>2. Check jumper installation.</li> <li>3. Immediately disconnect AC power supply, check wiring.</li> </ol>
Counter does not increment or decrement when sensor is activated.	<ol style="list-style-type: none"> <li>1. Sensor malfunction, improperly installed or connected.</li> <li>2. Incorrect count mode selected for type of sensor being used.</li> <li>3. Reset input (terminal #17) connected to DC Common.</li> <li>4. Low frequency select terminals (terminals #11 and #13) connected to DC Common when sensor generates count pulses less than 1 msec long.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check sensor wiring, installation and operation.</li> <li>2. Check Function Code diagram (Fig. 21) for proper value selection for Function 60.</li> <li>3. Check wiring.</li> <li>4. Disconnect low frequency terminals.</li> </ol>
Counter counts in wrong direction	<ol style="list-style-type: none"> <li>1. Quadrature shaft encoder outputs A and B reversed.</li> <li>2. Add and Subtract signals reversed.</li> <li>3. Improper count mode selected for sensor configuration utilized.</li> <li>4. Polarity of up/down control signal reversed when Count With Direction Control mode is selected.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reverse wiring on inputs 1 and 2 (terminals #14 and #10).</li> <li>2. Reverse wiring on inputs 1 and 2 (terminals #14 and #10).</li> <li>3. Check Function Code diagram (Fig. 21) for proper value selection for Function 60.</li> <li>4. Invert up/down control signal on terminal #10 with an external relay or transistor.</li> </ol>

**Figure 34. Troubleshooting**

## TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSES	REMEDIES
Counter accumulates too many counts	<ol style="list-style-type: none"> <li>1. Electrical noise causing extra counts.</li> <li>2. Loose wires between sensors and count inputs.</li> <li>3. Sensor generation extra pulses due to vibration, oscillation, chatter or jitter.</li> </ol>	<ol style="list-style-type: none"> <li>1a. Check sensor lead installation to insure that they are not bundled with other power wiring.</li> <li>1b. Connect low frequency select terminals (terminals #11 and #13) to DC Common if pulses from the sensor are longer than 1 msec.</li> <li>1c. Use shielded cable for wiring sensors to Count Inputs (terminals #10 and #14) and connect the shield to terminal #32.</li> </ol> <ol style="list-style-type: none"> <li>2. Check external sensor wiring.</li> <li>3. Check sensor mounting and motion of machine to determine if these characteristics cause extra counts. Use Quadrature encoders where applicable.</li> </ol>
Counter misses preset 1	Bypass preset 1 input is connected to DC Common.	Check wiring on terminal #1.
Counter counts to preset 1 and recycles	Auto recycle mode is selected to auto recycle at preset 1.	Check entry at Function 81.
Relays and transistor outputs energize but do not deenergize.	No option selected to unlatch outputs.	Utilize unlatch inputs, Unlatch at Reset mode, Latch Until Reset Complete mode, Unlatch At Alternate Preset mode, or Timeout mode.
No printout or incorrect printout is generated when the control is connected to a printer	<ol style="list-style-type: none"> <li>1. No AC power applied to printer.</li> <li>2. Printer improperly set up.</li> <li>3. Serial communications output incorrectly wired to printer.</li> <li>4. Baud rates of control and printer not setup to the same value.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check AC power connections and fuse in printer.</li> <li>2. Check printer DIP switches for correct setup. (See Printer Installation Manual).</li> <li>3. Check that the SDO+ (terminal #35) on control is connected to SDI- on printer and SDO- (terminal #36) is connected to SDI+.</li> <li>4. Check that the Baud rates of the control and the printer are the same.</li> </ol>

**Figure 34. Troubleshooting (Continued)**

## TROUBLESHOOTING

---

### CHECK-OUT PROCEDURE

If the control does not perform satisfactorily, check all connections, proceed through the troubleshooting chart on the previous pages, and check all function codes for proper set-up according to the table given in Figure 21. If these tests proceed correctly and the control is still not properly functioning, remove ALL wiring from the back of the counter and proceed through the following steps. If the control fails to function in any of the steps, return it to Durant Products, Attn: Repair Department, 901 South 12th Street, Watertown, WI 53094. Enclose a letter describing the malfunction.

#### Power Input

Connect 115 VAC between terminals #25 and #26. Jumper terminal #25 to terminal #28 and jumper terminal #26 to terminal #27. The display should flash for a short period of time and then remain lit. Place electrical tape over terminals #25 through #28 to prevent electrical shock during the next tests.

#### Keyboard

Press the "FUNCTION" key, the display should blank. Press "43" which the display should indicate. Press ENTER, the display should show "0". Press "1" which the display should indicate. Press "ENTER", the display should flash "0" and the "COUNT" indicator for a short period of time then remain lit.

#### Count Up

Make a momentary connection between terminals #10 and #12. The display should increment several counts. Make a connection with a short piece of wire between terminals #11 and #12 and repeat the count test between terminals #10 and #12. Retain the connection between terminals #11 and #12.

#### Count Down

Make a momentary connection between terminals #14 and #12. The display should decrement several counts. Make a connection with a short piece of wire between terminals #13 and #12 and repeat the count test between terminals #14 and #12.

Retain the connection between terminals #13 and #12. Decrement the counter until the display indicates less than #5".

#### Preset

Press the "PRESET 1" key and the display should show "0". Press the "5" key, which the display should indicate. Press the "ENTER" key. The display should blank for one half second then remain lit. Press the "COUNT" key, the display should indicate the previous count value. Make a momentary connection between terminals #10 and #12 at least five times. You should hear the output relay actuate.

#### Relay Timeout

Ten seconds after relay K1 actuates, you should hear it release.

#### Reset

Press the "RESET" key. The display should show "0".

#### Unlatch

Again make a momentary connection between terminals #10 and #12 at least five times. Before the ten second timeout elapses, make a momentary connection between terminals #2 and #8. You should hear output relay K1 release. Press the "RESET" key again.

#### Latch Until Reset Complete

Press the "FUNCTION" key, press "36", then press "ENTER". The display should indicate "0". Press the "1" key, then "ENTER". The display should show "1", blank for one half second then remain lit. Press the "FUNCTION" key, press 30, then press "ENTER". The display should show "10.00". Press the "0" key, then "ENTER". The display should show "0.00", blank for one half second then remain lit. Press the "COUNT" key, the display should indicate "0" and the COUNT indicator lit. Make a momentary connection between terminals #10 and #12 at least five times. You should hear the output relay activate. Press the "RESET" key. The display should display "0" and you should hear the relay release.



## TROUBLESHOOTING

---

### Auto Recycle

Press the "FUNCTION" key, press "81", then press "ENTER". The display should indicate "0". Press the "1" key, then "ENTER". The display should show "1", blank for one half second, then remain lit. Press the "COUNT" key, the display should indicate "0" and the COUNT indicator lit. Make a momentary connection between terminals #10 and #12 five times. You should hear output relay K1 activate and the display should show "0".

### Power Outage

Disconnect the AC power. You should hear relay K1 release.

### INTERNAL DIAGNOSTICS

The control has several internal diagnostic routines which allow it to self-test various operational characteristics. When power is applied, the control tests its memory to determine if it has retained all of the values and function code parameters previously entered. It also tests to insure that all of the internal memory is functional. During these self-tests, the display is blanked. Since the tests are performed very quickly, the user usually does not notice the short delay on power-up.

The user also has the ability to initiate the control self-test diagnostics at any time. Function code 40 is used to initiate the diagnostics. If the control fails any of the diagnostic routines, either on power-up or upon manual command, the display will flash a number indicating which of the six self-tests failed. If no failures are found, the control returns automatically to normal operation.

#### NOTE

The self-diagnostics should not be performed while the process being controlled is running. The control responds to count pulses but ignores any incoming control signals while the diagnostics are operating.

### Description of the Diagnostics

The diagnostics which are included and their related test numbers are as follows:

- #1 - ROM (Read Only Memory) 16 Bit Checksum
- #2 - Internal RAM (Random Access Memory)

#### Bit Test

- #3 - Non-Volatile RAM Read/Write Bit Test
- #4 - Non-Volatile RAM Store Test
- #5 - Non-Volatile RAM 8 Bit Checksum
- #6 - Watch Dog Timer (1.3 Seconds) Timeout

### ROM (Read Only Memory) 16 Bit Checksum - Test #1

This test determines if the permanent memory which controls how the control operates is good.

### Internal RAM (Random Access Memory) Bit Test - Test #2

This routine tests the temporary workspace memory used for normal operation and communication. If a failure occurs, the counter may change or lose values or operating characteristics unexpectedly.

### Non-Volatile RAM Read/Write Bit Test - Test #3

This test checks the memory which permanently stores the operating characteristics and values when a power outage occurs.

### Non-Volatile RAM Store Test - Test #4

This test insures that the non-volatile memory accurately stores and retrieves the programmed operating characteristics and values upon a power outage. If a failure of this type occurs, the counter will operate correctly but could change its values or operating characteristics upon a power failure or power drop-out.



**CAUTION**

**TO INSURE PROPER OPERATION, CHECK ALL FUNCTION CODE VALUES BEFORE STARTING THE PROCESS. NOTE THAT A TEMPORARY POWER INTERRUPTION MAY CHANGE THE VALUES OF FUNCTION CODES DURING THE PROCESS IF TEST #4 HAS FAILED.**

### Non-Volatile RAM 8 Bit Checksum Test -Test #5

A checksum test is performed on the non-volatile memory to insure that none of the information stored was changed while the control was unpowered. If this test fails, check all function code values and the values of the counter and preset to insure they are correct. Then disconnect and reconnect power to perform this test again. If the

## TROUBLESHOOTING

---

test fails the second time, return the counter for repair.

### Watch Dog Timer (1.3 Seconds) - Test #6

While the control is operating, an internal Watch Dog Timer is incremented every millisecond. Under normal operation, the control automatically resets the Watch Dog Timer at least once per second. If the control would malfunction during operation, the Watch Dog Timer may time out (depending on the type of malfunction) and an error code of "6" flashes on the display. If this type of failure occurs, run the diagnostics using Function 40. Excessive electrical interference may cause this type of failure without damage to the control or the operating characteristics. If the diagnostics find no other fault, it is reasonable to assume that the control is fully operational, unless this failure is recurring.

### OPERATION OF DIAGNOSTICS

When power is applied, the control begins by performing tests #1, #2, #3 and #5. If all of these pass, the counter is ready to operate as indicated by flashing the count value on the display at one half second intervals for four seconds, then remaining lit.

To select the self-diagnostic mode, specify Function code 40 and enter a value of "1". The control immediately turns on all display segments and LED indicators for 2 seconds. Then the displays blank and the control steps through all five tests. If all five pass, the control begins a display and LED test routine. This routine sequences through flashing the numbers "0" through "9" on the displays, alternates the Preset 1, Preset 2 and Count LED indicators and moving the decimal point from digit to digit. When the display sequence is finished, the control shows the count value and the Count indicator is lit.

#### NOTE

The self-diagnostics should not be performed while the process being controlled

is running. The control responds to count pulses but ignores any incoming control signals while the diagnostics are operating.

Performing the diagnostic routines does not affect the Function code parameters. Thus, when the diagnostics are finished, the control retains all of the operational characteristics previously programmed.

### WHAT TO DO IF THE CONTROL FAILS A DIAGNOSTIC TEST

If the control flashes a single digit number continuously on power-up or when the self-diagnostics are performed, it indicates which one of the tests has failed. When the number displayed is "4", "5", or "6", the control can be allowed to operate by pressing the FUNCTION key to clear the display.



### **RUNNING THE COUNTER AFTER A FAILURE HAS BEEN DETECTED CREATES A SERIOUS RISK TO THE OPERATOR AND/OR MACHINERY.**

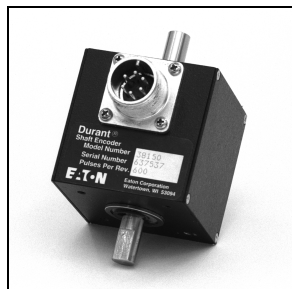
As a minimum safety precaution, the Function code Default mode (Function 43) should be selected (enter a value of "1") and the Function codes reprogrammed. This will insure that the failure has not altered any of the operating characteristics of the counter. Selecting the default parameters with Function 43 also performs the power-up self test, which could give another failure indication (for tests #1, #2 or #3). If this occurs, return the control for repair immediately.

Address units to be repaired to:

Cutler Hammer-Eaton Corporation  
Durant Instruments  
901 South 12th Street  
Watertown, WI 53094  
ATTENTION: REPAIR DEPARTMENT

## TRANSDUCERS, ACCESSORIES AND REPLACEMENT PARTS LIST

### TRANSDUCERS

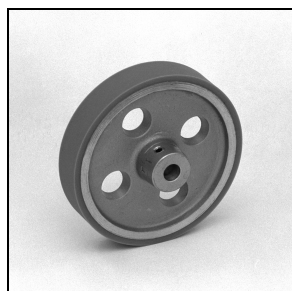


**Medium Duty Shaft Encoder**  
Single Channel - 38150-XXX  
Quadrature - 38151-XXX

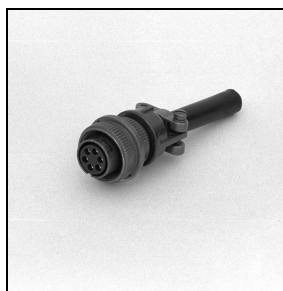


**Heavy Duty Shaft Encoder**  
Single Channel - 48370-XXX  
Quadrature - 48371-XXX

60, 100, 120 and 600 PPR are stocked ratios for encoders  
Any number from 001 to 600 is available.  
Substitute the desired PPR for "XXX" in the part numbers.



**12" Measuring Wheels with 3/8" Bore**  
Aluminum Rimmed 20156-301  
Rubber Rimmed 20154-301  
Urethane Rimmed 20144-301



**Connector for Encoder**  
29729-300



**Connector with 10 Foot Cable**  
29665-300



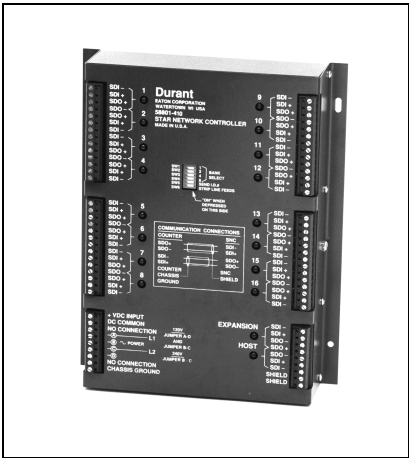
**Rotary & Lineal Contactor**  
ES-9513-RS



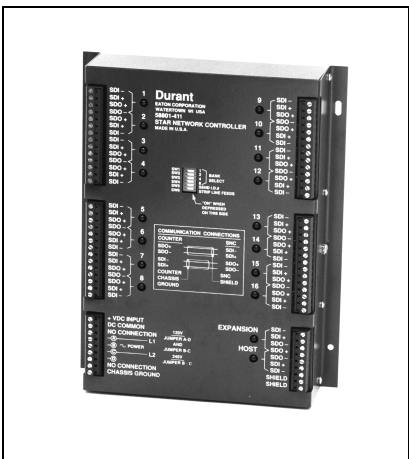
**Mounting Bracket for ES-9513-RS**  
40460-400  
Shown with ES-9513-RS and 12" measuring wheel

TRANSDUCERS, ACCESSORIES AND REPLACEMENT PARTS LIST

ACCESSORIES



**Serial to Parallel BCD Communications Convertor 58801-410**  
The Serial to Parallel BCD Communications Convertor (SPCC) is a serial to parallel BCD adapter which provides a means of interfacing a Durant counter to a ladder logic based Programmable Control. The SPCC converts the serial data from the counter's 20ma current loop to eight digits of binary coded decimal data for use by the Programmable Control. The BCD output is connected to the I/O structure of the PC. Several options, conveniently selected by a four position DIP switch eliminates the need for a special configuration for each different application. The SPCC has a self contained power supply which requires 115VAC power.



**Parallel BCD To Serial Communications Convertor 58801-411**  
The Parallel BCD to Serial Communications Convertor (PSCC) is a parallel BCD to serial Adaptor which provides a means of interfacing a Durant counter with a ladder logic based Programmable Control. The PSCC converts eight digits of binary coded decimal data from a PC to serial data to be input to the Durant counter through the counter's 20ma current loop. The BCD input is connected from the I/O structure of the PC. Several options, conveniently selected by a four position DIP switch, eliminates the need for a special configuration for each different application. The PSCC has a self contained power supply which requires 115VAC power.



**Simultaneous Input Processor**  
The Simultaneous Input Processor (SIP) is used as an accessory with Durant counters to insure that all counts are recorded when multiple sources of count signal are required (counts can occur simultaneously).

8 input	49990-408
16 input	49990-416

## TRANSDUCERS, ACCESSORIES AND REPLACEMENT PARTS LIST



### Timer Module

48160-440

The Durant Timer Module, 48160-440, provides a series of timed output pulses at a rate selectable by the user. The selection is made by setting a DIP switch located on the side of the module. A variety of pulse rates, from 1,000 pulses per second to 10 pulses per minute, can be set on the switch. The timer module will convert any Durant electronic counter or count control with a high speed (5000 Hertz) input into a timer.



### Input Signal Conditioner

48160-400

The Model 48160-400 Signal Conditioner converts a wide range of input signals to a level that is compatible with Durant Electronic Controls. It will accept differential inputs from 50 millivolts to 400 volts and ground referenced inputs from 2.4 volts to 100 volts.



### Relay Module

This unit has two relays that may be operated by transistors that are rated to carry at least .075A in a 12-volt circuit. Each relay has DPDT contacts for controlling external loads. The relays are plug-in type for easy replacement. The 12-volt power for the relays is provided from the AC input.

115 VAC input power 51611-400

230 VAC input power 51611-401



### Desk Mounting Kits

These attractive mounting kits fit the Durant Series 5880 count controls for installation on any flat surface. The convenient two piece "snap together" design requires no tools for assembly. Four non-skid rubber feet prevent the control from sliding on the mounting surface. Standard conduit knockouts are provided on the rear of the kit for wiring to the process. The 58802-410 kit fits the 5881-0400 Totalizer. The 58802-420 kits fits all other 5880 series count controls.

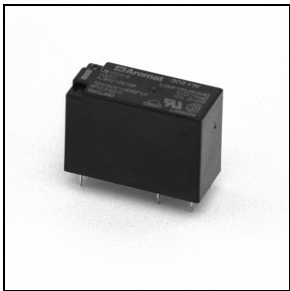
58802-410

58802-420

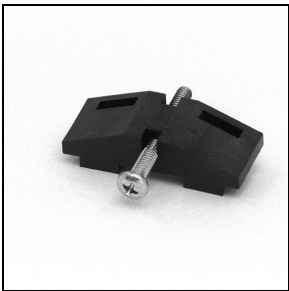
**TRANSDUCERS, ACCESSORIES AND REPLACEMENT PARTS LIST**

---

**REPLACEMENT PARTS**

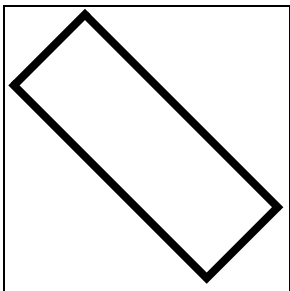


**Replacement Relay**  
Eaton No: 38133-202  
Aromat No:  
JW1FEN-B-DC5V

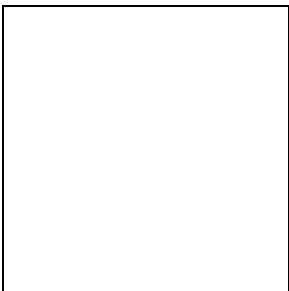


**Mounting clip**  
48433-200

**Screw**  
29801-187



**Front Panel Gaskets**  
All Controls  
28720-216  
  
Totalizer (5881-0400)  
28720-215



**Front Panel Spacer**  
Adapter to JIC enclosures  
All Controls  
3882-0400  
Totalizer (5881-0400)  
3881-0400

Printed in U.S.A.

Cutler-Hammer  
901 South 12th Street  
Watertown, WI 53094  
920-261-4070 . 800-540-9242 . FAX 920-261-9097